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ELECTRICAL REVIEW

RIDAY
EMBER 1958

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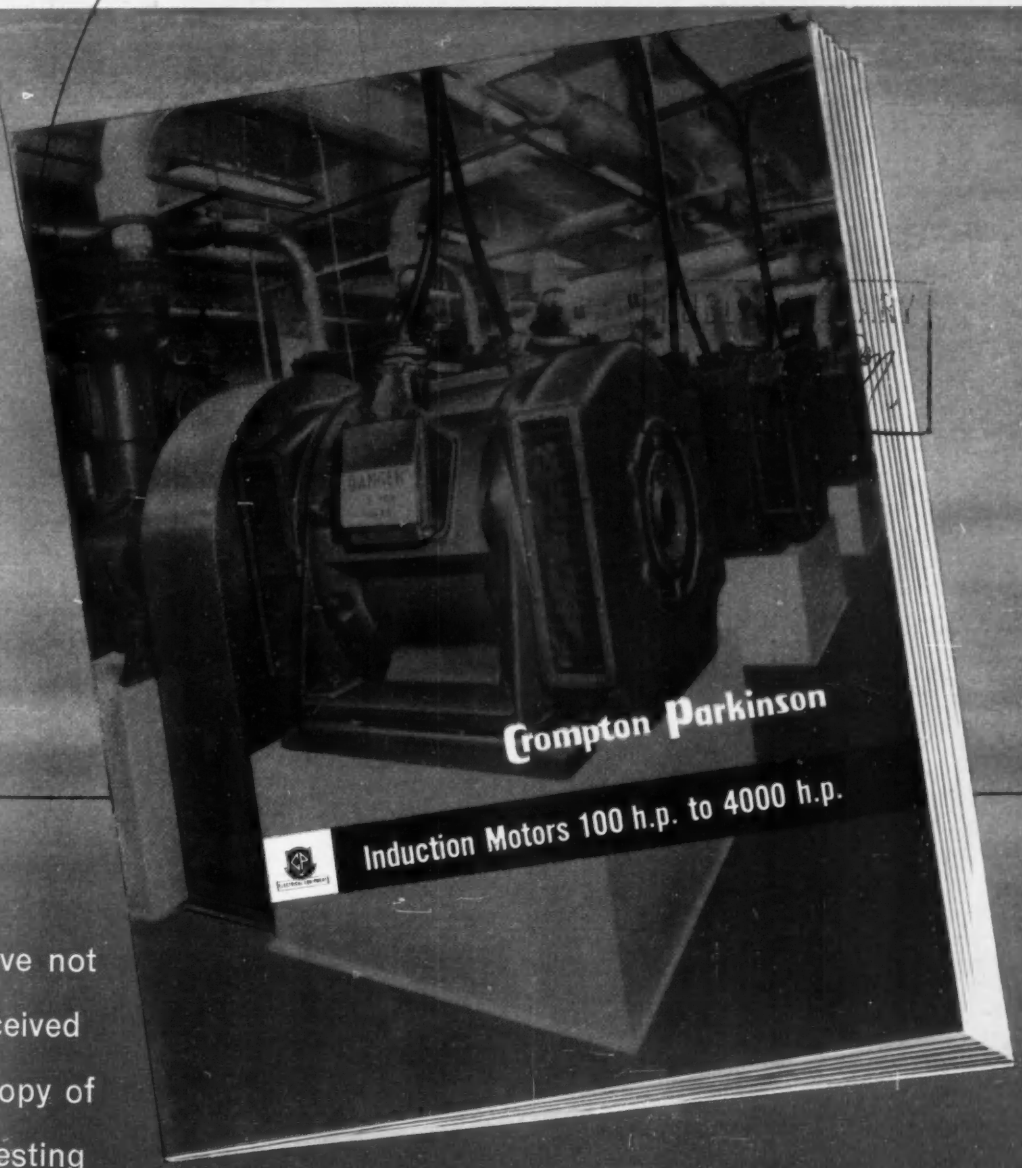

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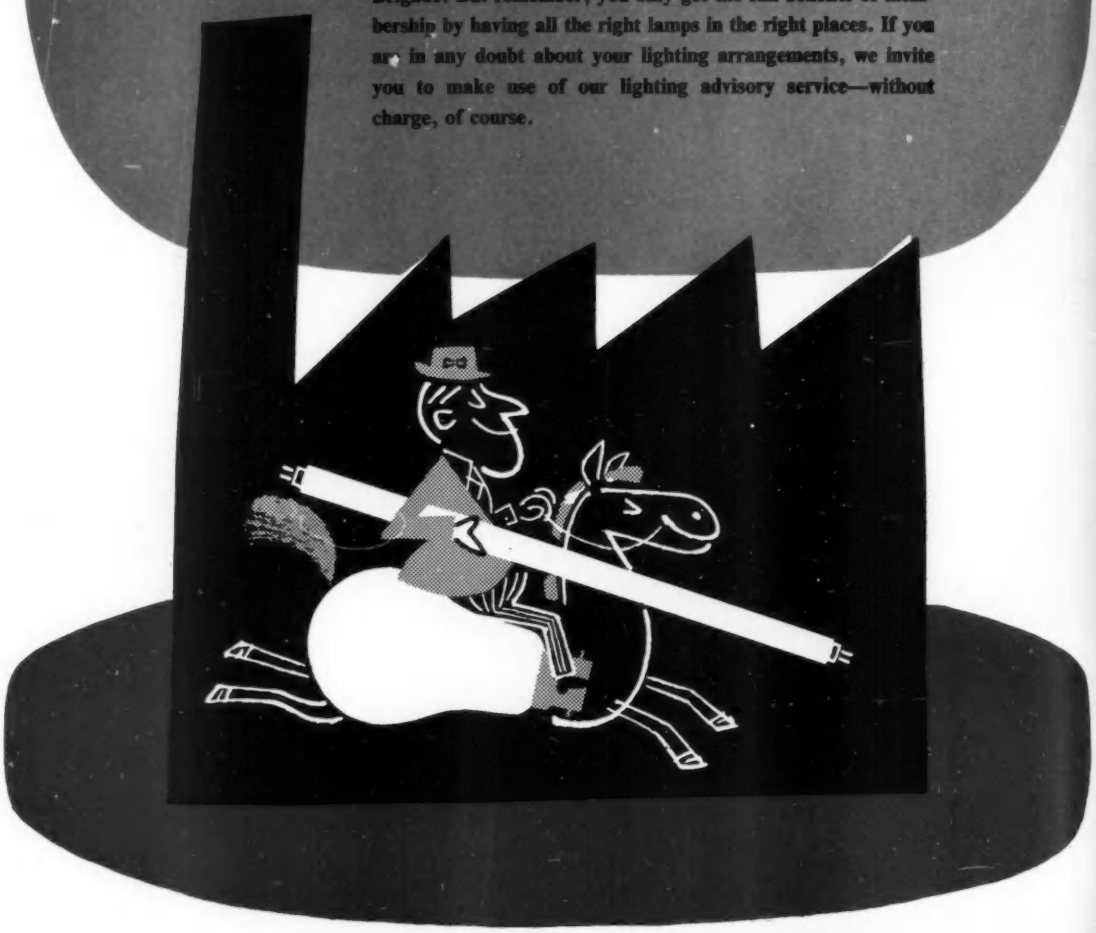

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Photograph by courtesy of Thorn Electrical Industries Ltd.

A.C. VOLTAGE: 25 mV. to 2,500 volts.
A.C. CURRENT: 1 mA. to 10 amps.
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D.C. CURRENT: 0.5 microamps to 10 amps.
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RESISTANCE:
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Weight: 6½ lbs. (approx.) including leads.

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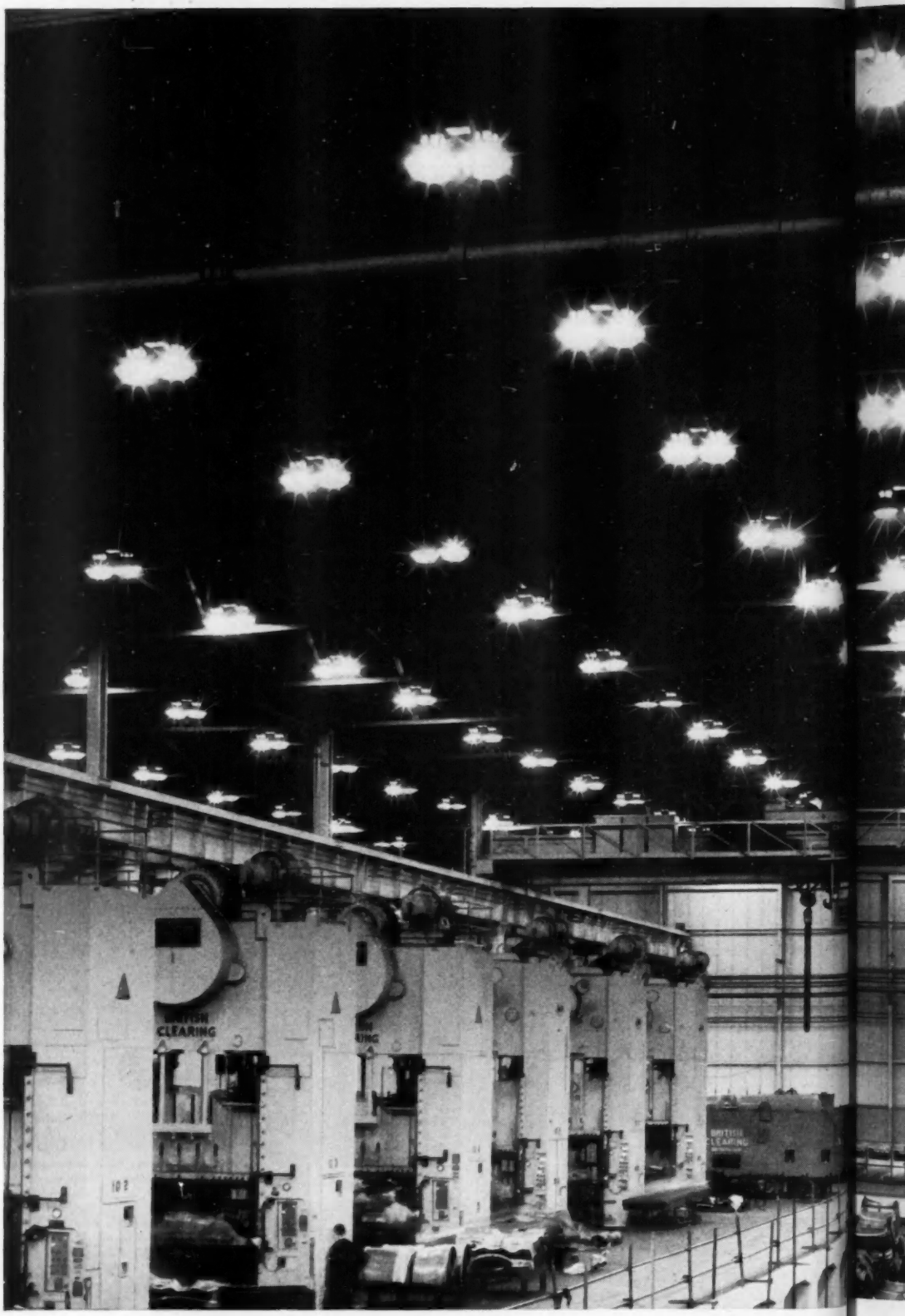
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by REVO

By installing these "Duo-Lite" Industrial Reflector Fittings, Revo engineers solved many of the lighting problems of the Ford Motor Company Ltd.

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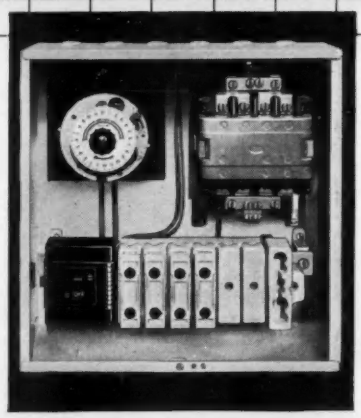
Under-floor heating and other off peak loads need these MEM Consumer's Control Units

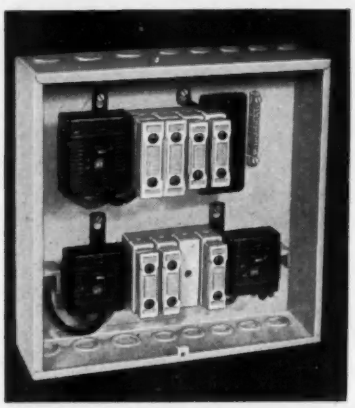
Here is the MEM answer to the off peak load problem. The unit 2FHC/R on the right is designed for control of night load only, for those installations where the day load is already controlled and protected by separate control equipment. The unit comprises a mild sheet steel case 12" x 12" x 5", finished Ivory enamel. The front cover is sealable. The control unit contains a "MEM-AC" 60 amp. 250v. double pole main switch, and a time switch, which operates the 60 amp. single pole, 250 volt, 50 cycle "AUTOLINE" contactor.

The under-floor heating or storage heaters and water heater circuits are protected by 6-15 amp. "MEMCERT" S.P. & N. fuses.

The unit 3FHC/R illustrated below is designed to operate as a central control for the normal day load comprising lighting, power plugs, etc. In addition, within the same enclosure, main switches and circuit fuses are fitted for the control and protection of under-floor heating circuits, storage heaters, etc. Where desired, control units can be provided with time switch and "AUTOLINE" contactor for timed automatic control of the night load.



2FHC/R



3FHC/R

Prices can be quoted for Control Units to customers' own specifications.

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An extra selling point for your product

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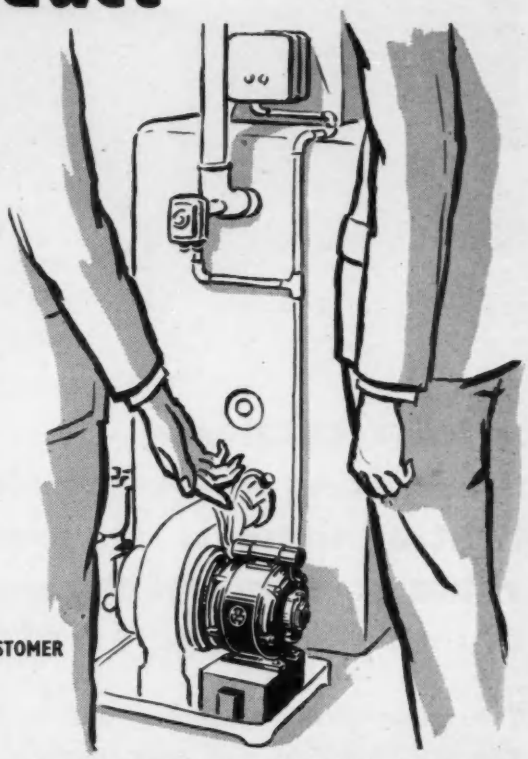

SCOPE FOR THE DESIGNER — DEPENDABILITY FOR THE CUSTOMER

BTH 'fractionals' are made in a wide range of sizes, from one-thousandth h.p., including AC and DC types. Many of these motors are produced with a choice of mountings and fittings so that the machinery designer can achieve maximum efficiency with the most compact and attractive design. The long life and trouble-free service of BTH 'fractionals' are well known.

A 'FRACTIONAL' ADVISORY SERVICE FOR DESIGNERS

The long experience of BTH engineers with 'fractionals' for all purposes is at the disposal of designers. Consultation at the drawing board stage can save you time and trouble. When you are planning new machines or modernising existing installations, get in touch with BTH.

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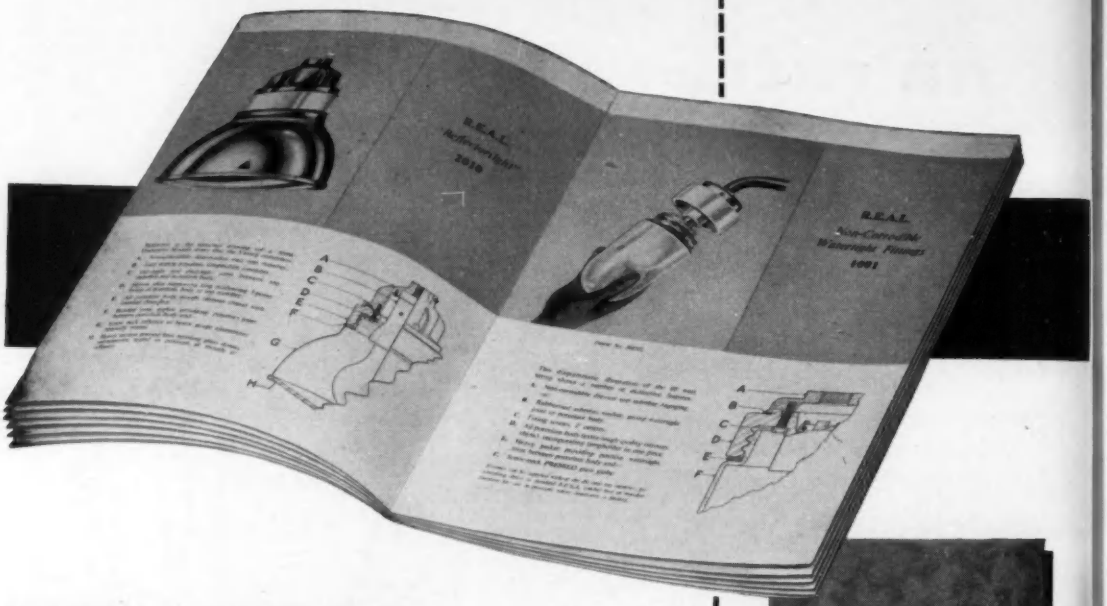

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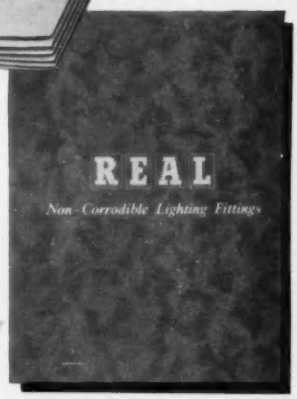

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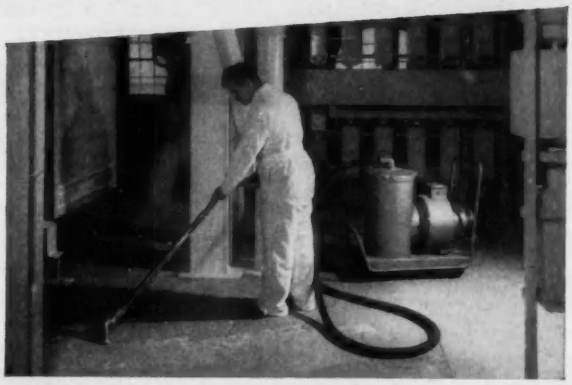

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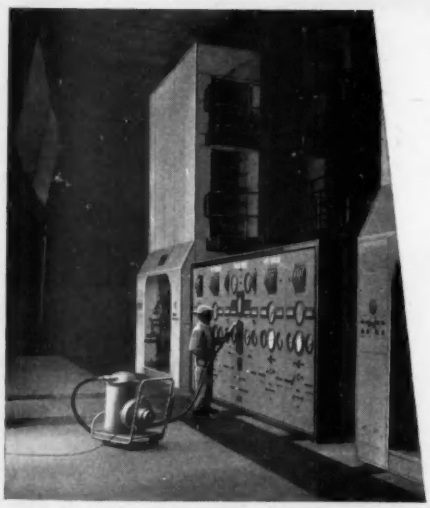
bring higher standards of cleanliness



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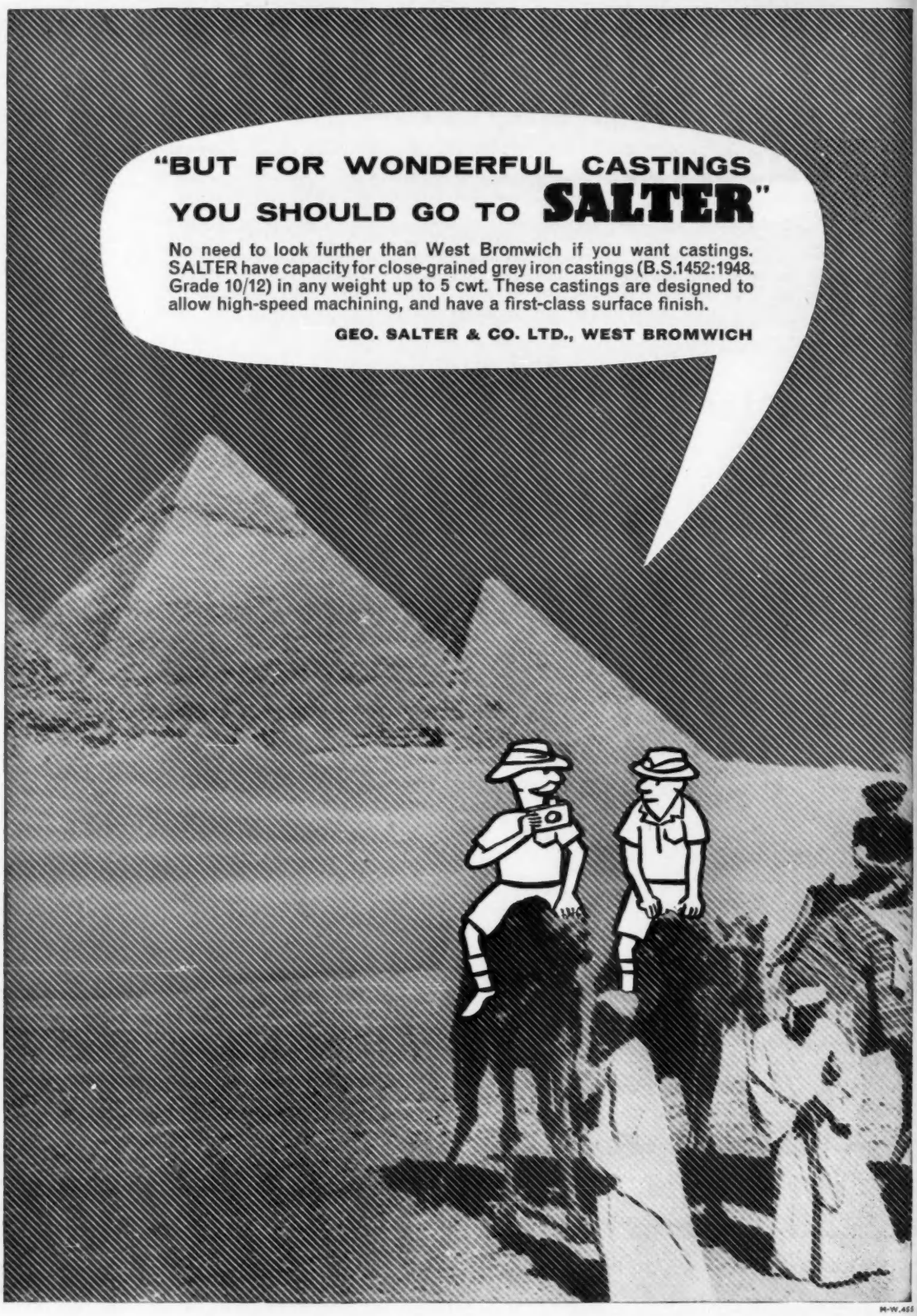
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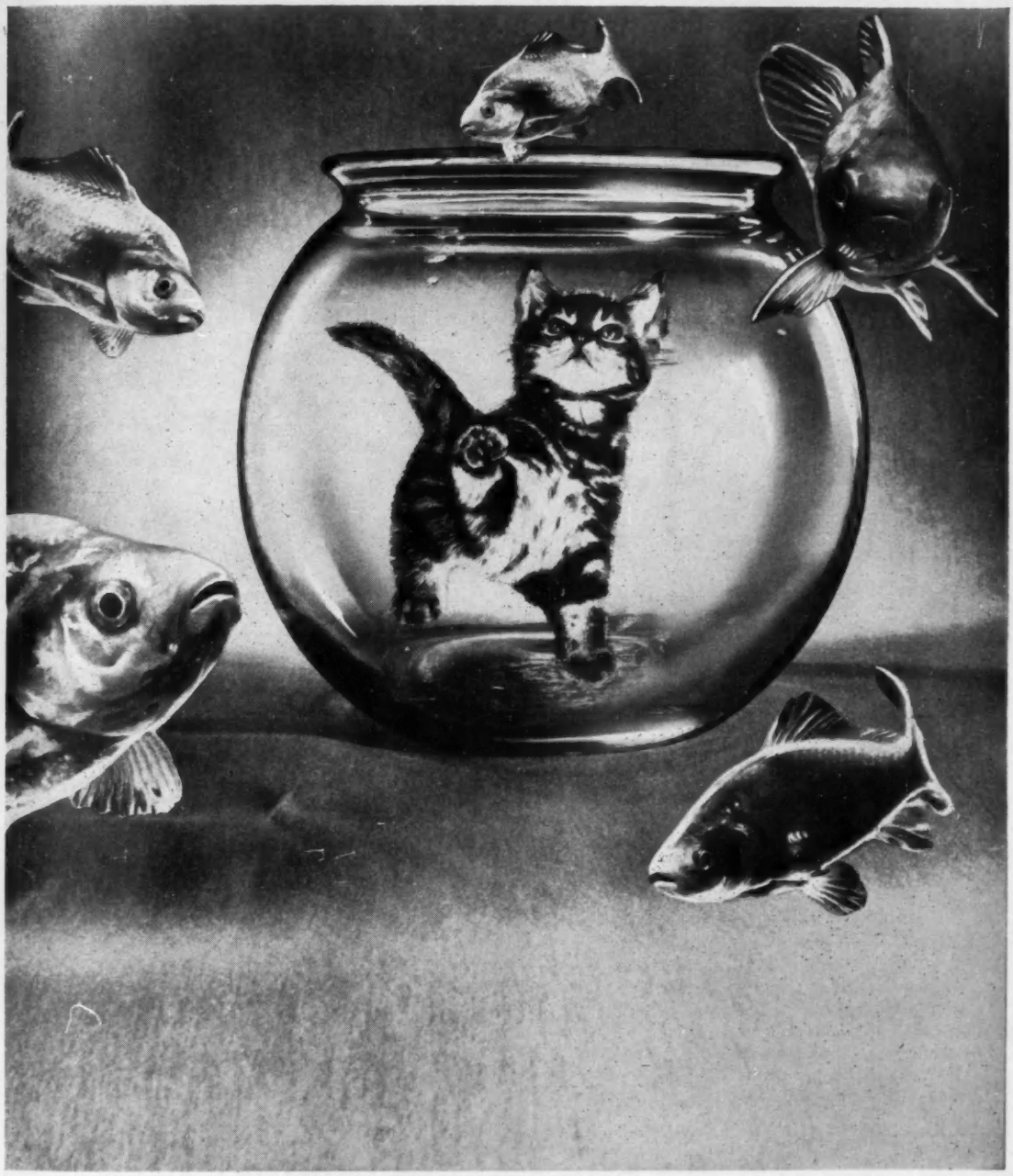

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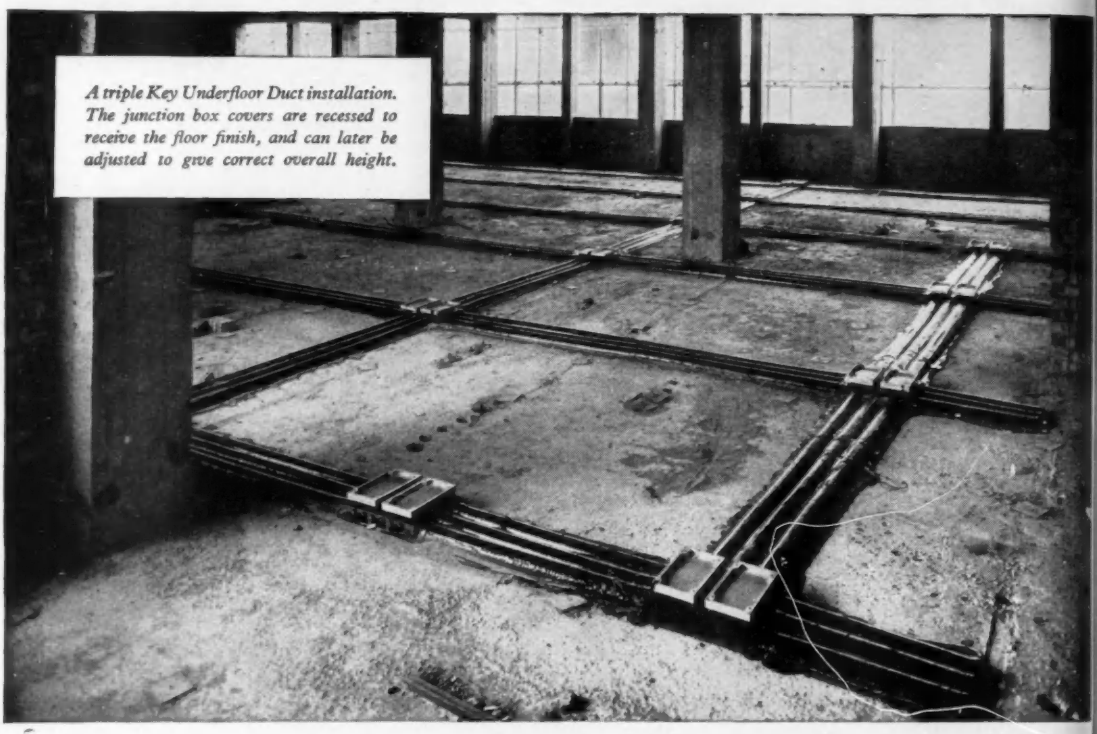

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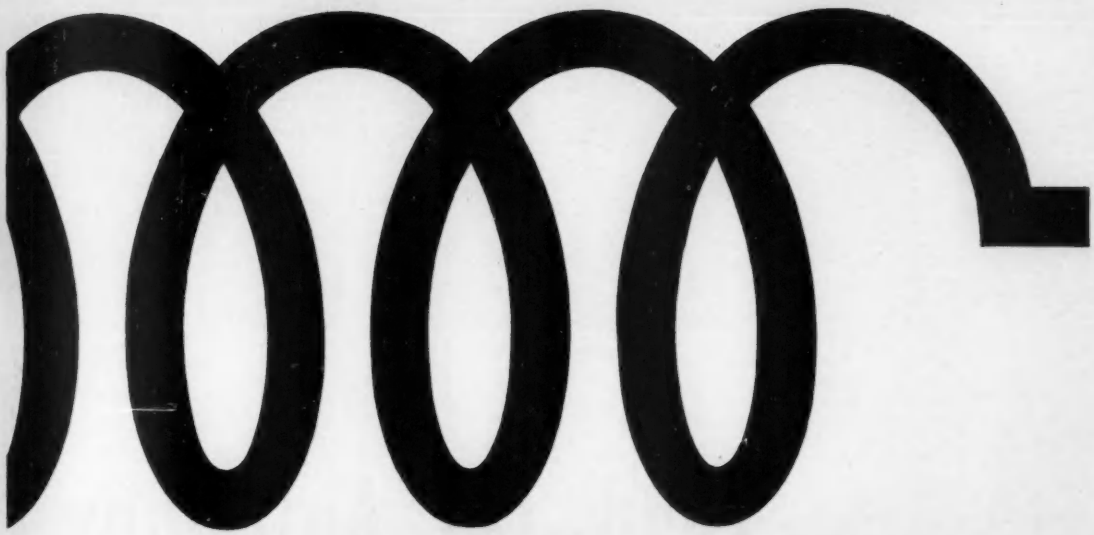
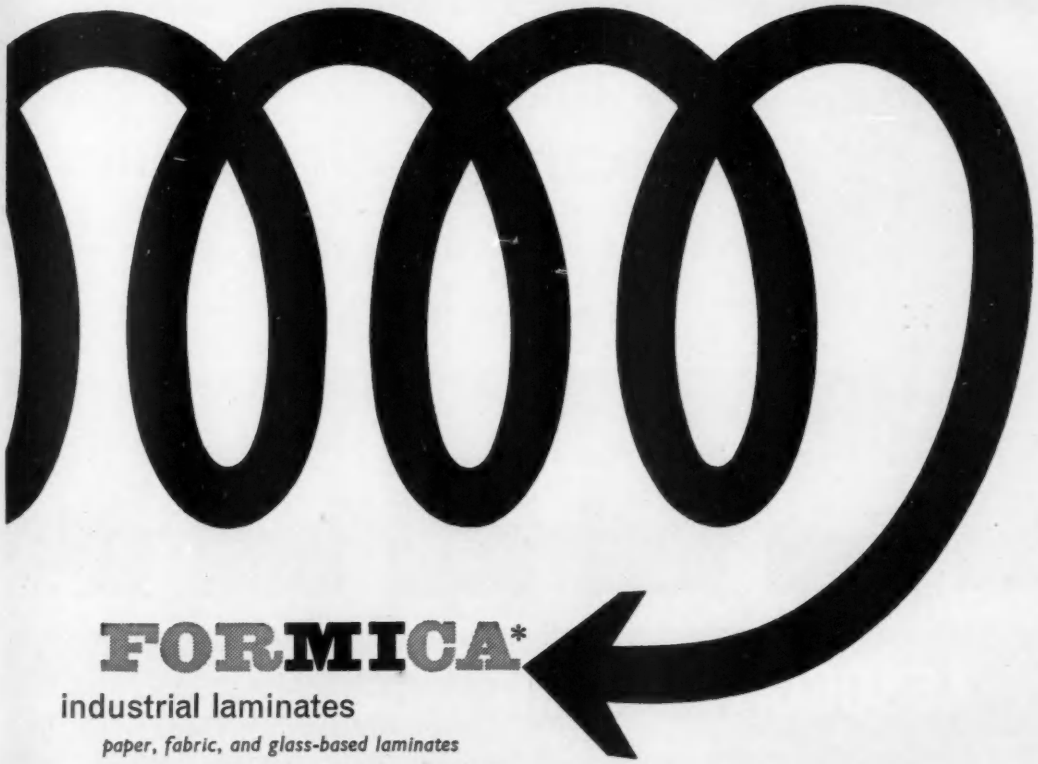


FORMICA for electrical insulation



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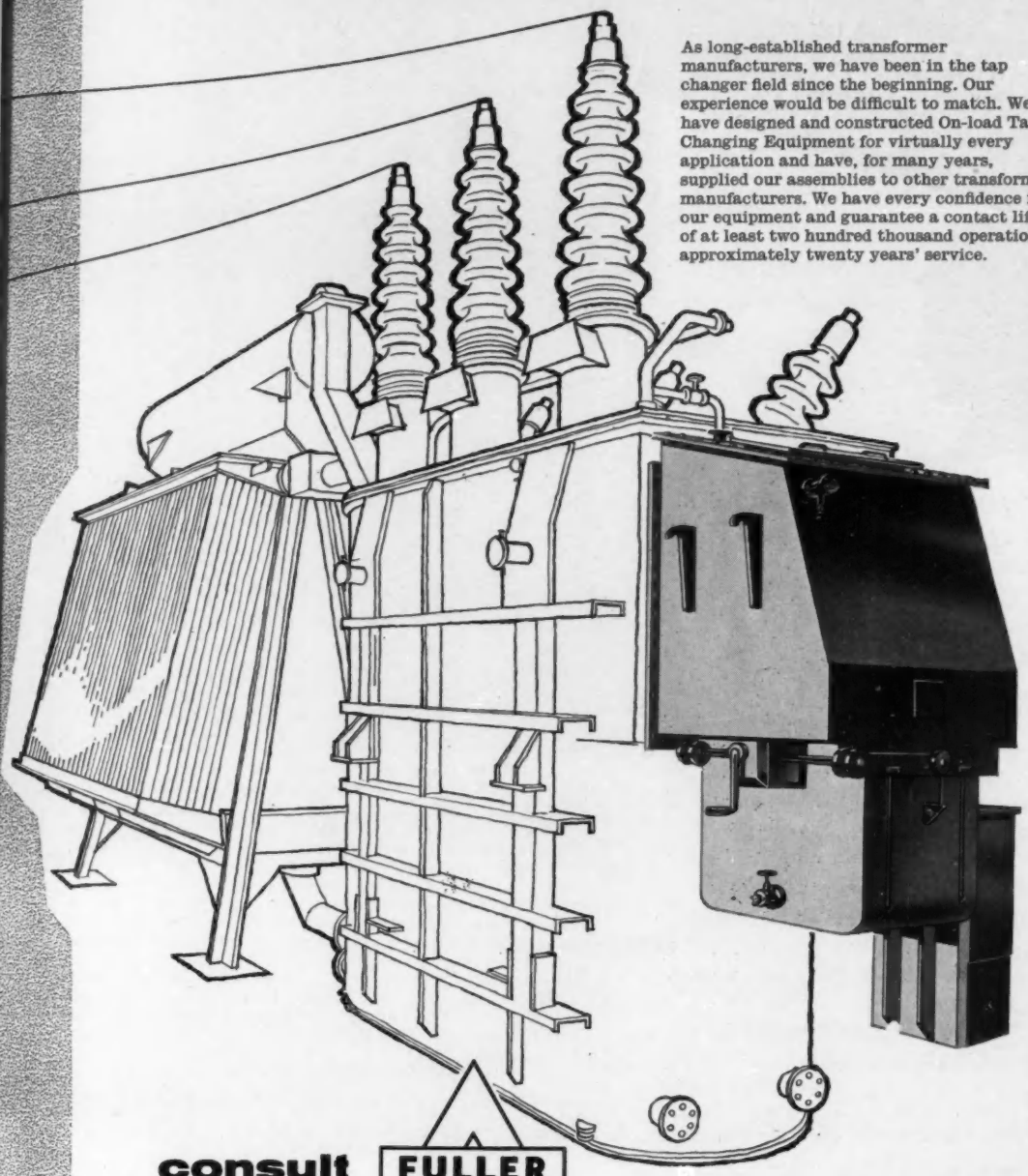

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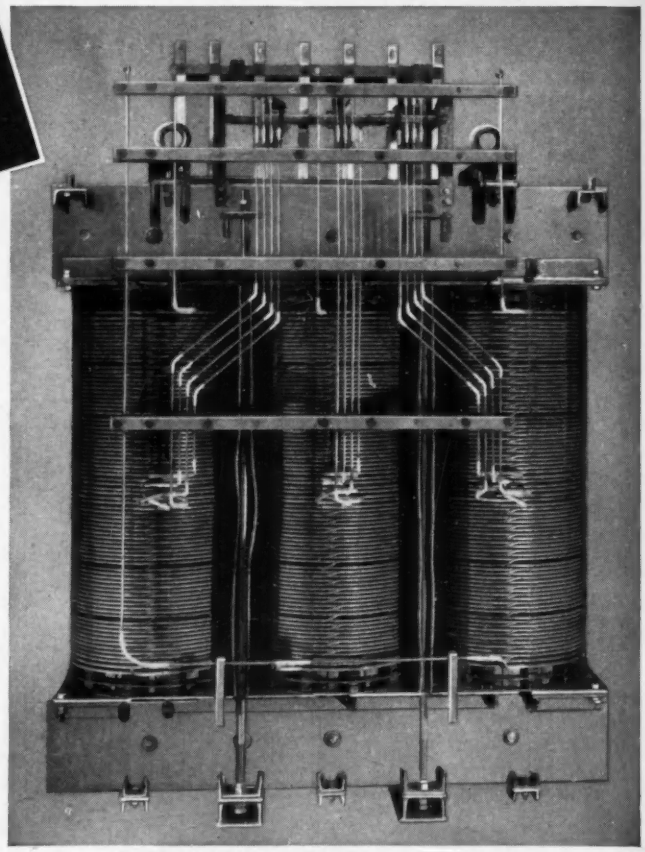

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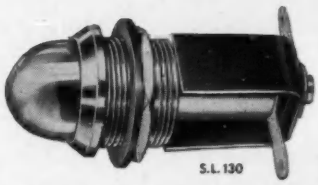
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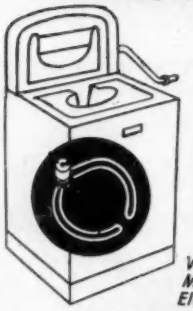
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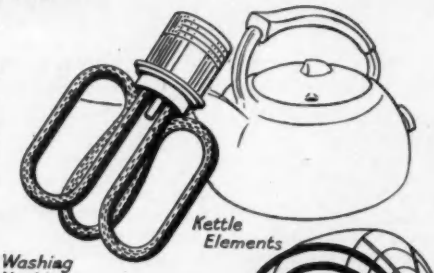
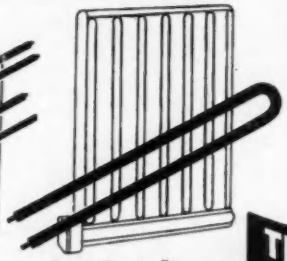
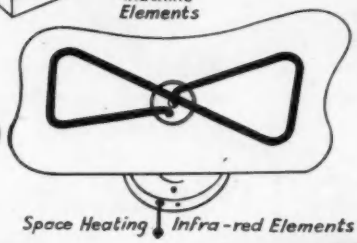

Kettle Elements

Water Heater Elements


Space Heater Elements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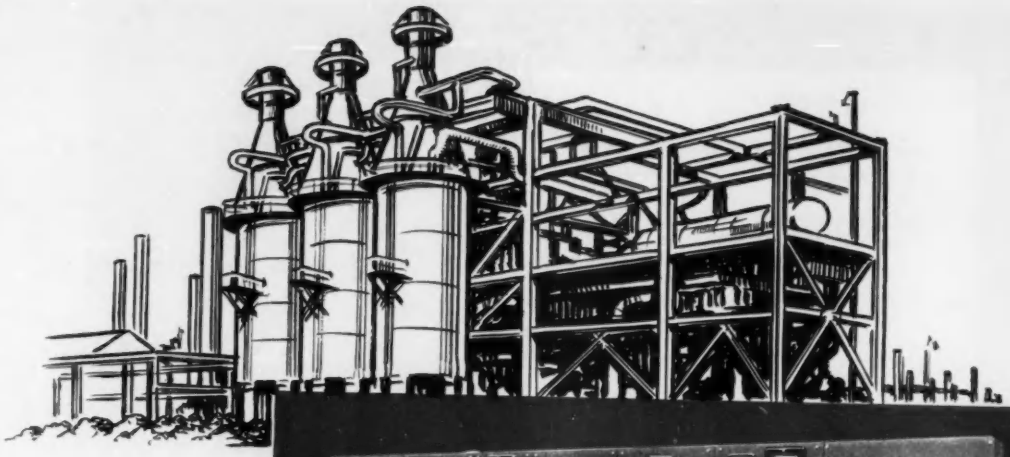

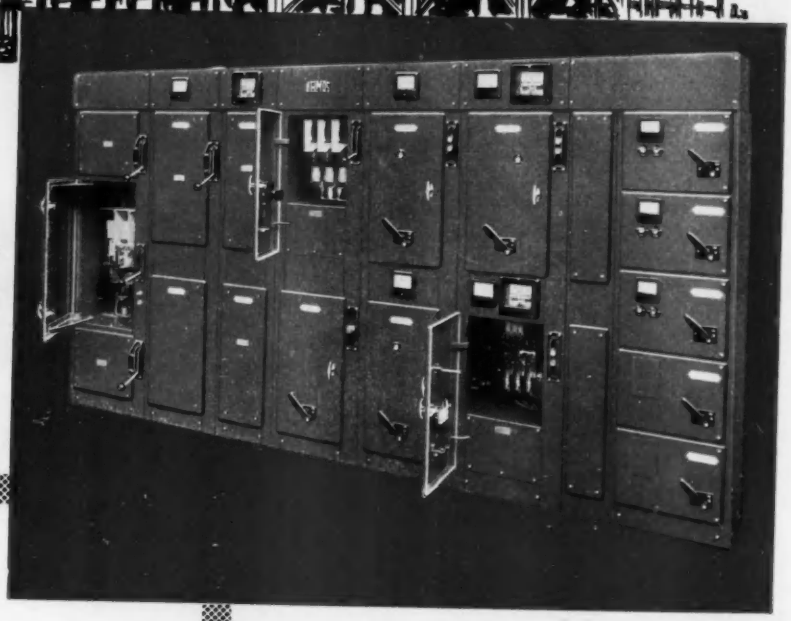

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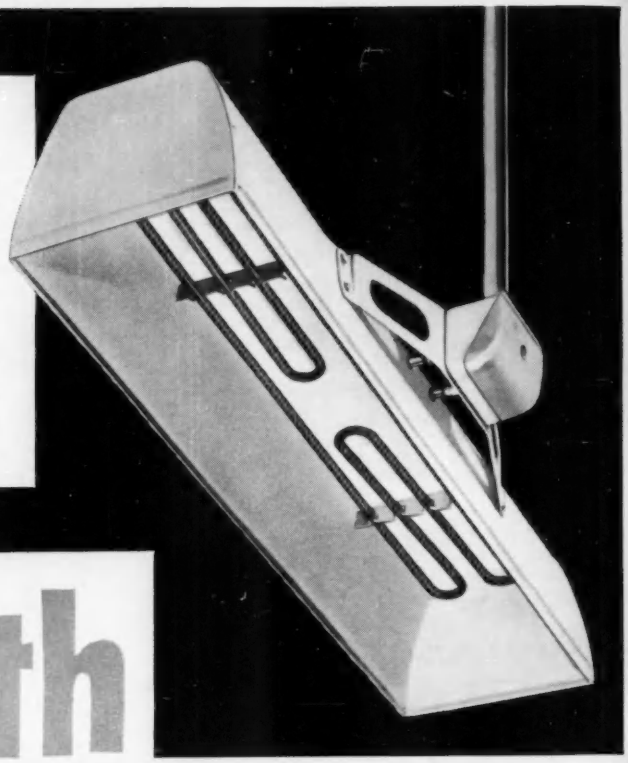
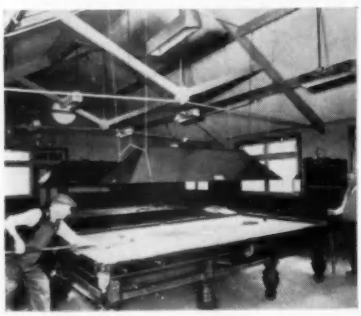
METROVICK RADIANT SPACE HEATERS can be used in countless situations indoors and out where other methods are either too costly or impracticable. They provide an efficient and highly economical method of heating churches, canteens and other buildings which are occupied only for short, intermittent periods.

A Metrovick radiant space heater suspended on conduit.



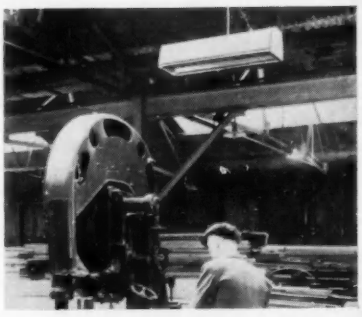
Warmth

projected where and when you want it!



In canteens, billiard rooms and other areas, heating costs are confined to periods of actual use with Metrovick radiant heaters.

At gates and entrances for watchmen and porters, as well as for attracting custom to shops, Metrovick radiant space heaters give highly efficient local warmth with economy.



Localised warmth at machines and work benches, without the waste involved in heating unoccupied areas, is provided by Metrovick radiant space heaters.

The heater consists of an anodised aluminium reflector with a tubular sheathed, corrosion-resistant heating element and is available in 1½ and 3 kW ratings. Weighing less than 5 lb., it is easily erected on a single 1 in. conduit leading from the weather-proof, aluminium alloy terminal box. It can also be supplied with an ornamental bezel, allowing it to be mounted on conduit, built into the ceiling or suspended from chains.

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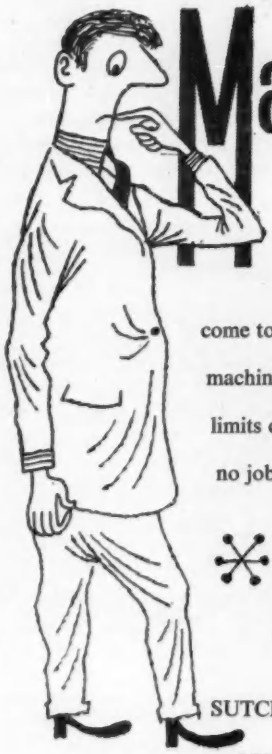

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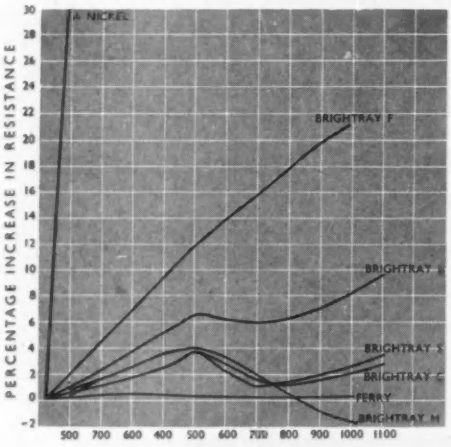
Changes in electrical resistance with temperature —a vital design consideration



Graphs showing resistance/temperature curves for various Wiggin electrical resistance materials.

In most electrical heating appliances, it is desirable that changes in the electrical resistance of materials with changing temperature should be slight. For other purposes, a high temperature coefficient of electrical resistance is an essential factor in design. Here are details of the way in which electrical resistance materials produced by Wiggin meet these varying requirements.

LOW TEMPERATURE COEFFICIENTS Brightray C, Brightray S and Brightray H offer a low temperature coefficient. Brightray B has a slightly higher coefficient, and it is usual to make allowances for this by basing calculations on the electrical resistance of the material at the operating temperature.

PROPERTIES FOR FURNACE ELEMENTS Brightray F has a somewhat larger coefficient but as this alloy is intended for furnace elements, where control gear will be used, the change may be compensated by voltage adjustment.

PROPERTIES FOR ELECTRICAL CONTROL GEAR An extremely low coefficient of resistance is offered by Ferry, a 45/55 nickel copper alloy which is available in a number of special grades. For this reason, it is used widely in control gear where constant resistance over a wide range of temperatures is necessary.

INCREASING RESISTANCE AS A MEASURE OF TEMPERATURE Nickel shows a marked increase of resistance as temperature rises and use is made of this property in devices such as resistance thermometers, where the change of resistance is used as a measure of temperature. It is also employed in electrically-heated blankets where increase of resistance with rise in temperature is used as an automatic temperature control.

EFFECTS OF MANIPULATION OR SPIRALLING The electrical resistance of a material is affected by mechanical work such as spiralling or manipulation during manufacture, but it will revert to a stable normal on slow cooling. The initial heating and cooling cycles experienced in service will be sufficient to achieve this result, and it is therefore important to base all calculations on resistance of the alloy in the slowly cooled condition.

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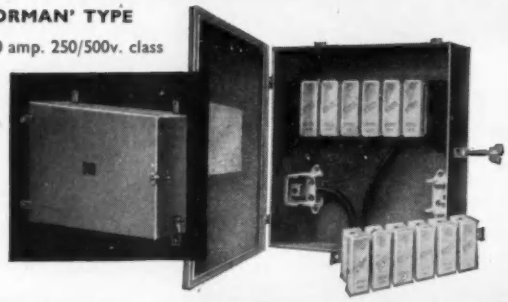
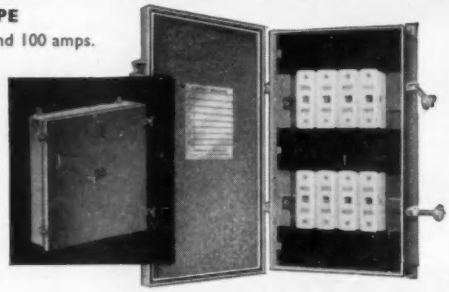


'ASC' TYPE
15/30, 60 and 100 amps.
500v. class



FLOWLINE PATTERN

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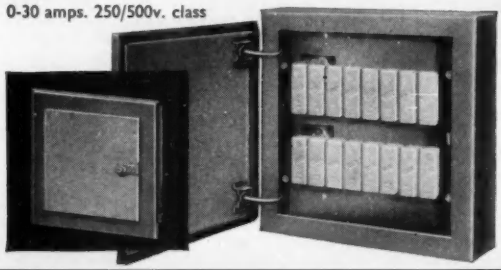

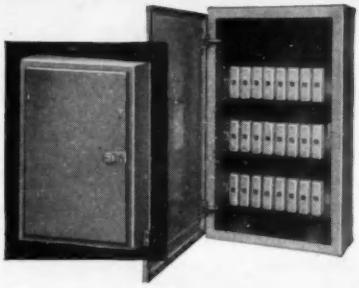

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and 100 amps.
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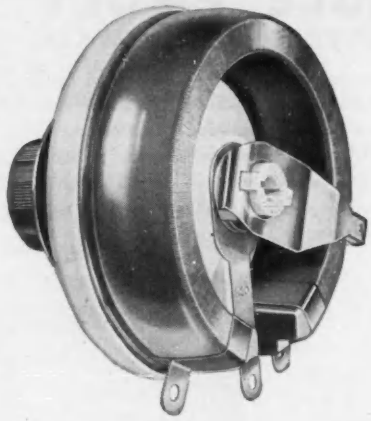

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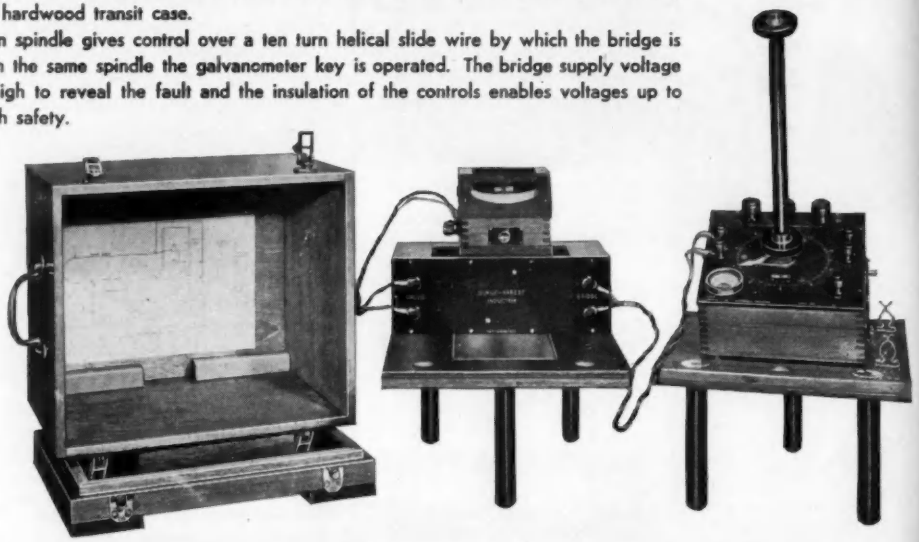

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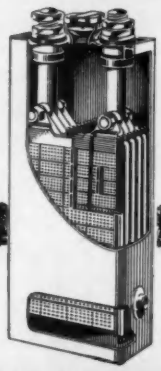

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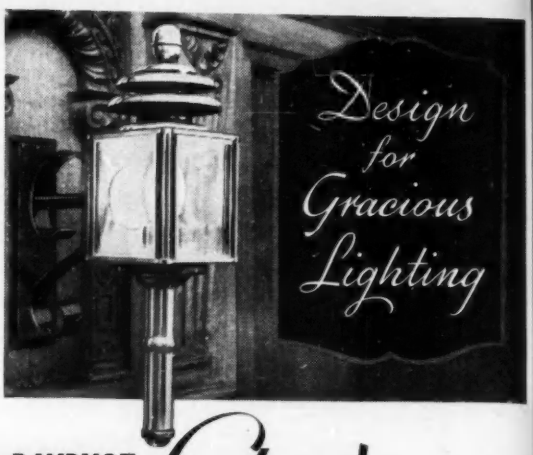

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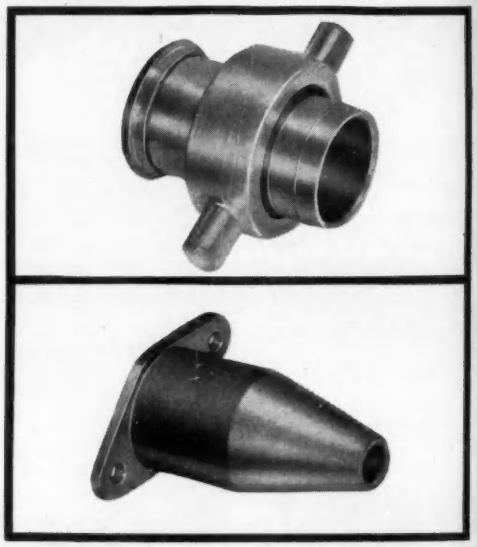

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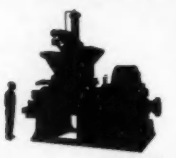
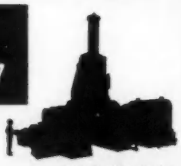


SIZE 9 BRIDGE-BANBURY



SIZE 27 BRIDGE-BANBURY

BRIDGE-BANBURY *Automation*

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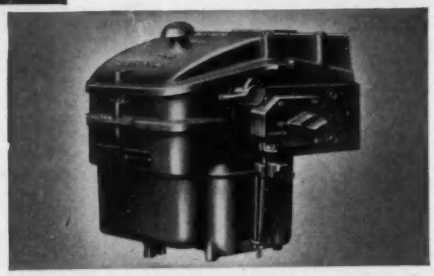
Phone: REGENT 7480 Grams and Cables: "EDERACEO" Piccy London

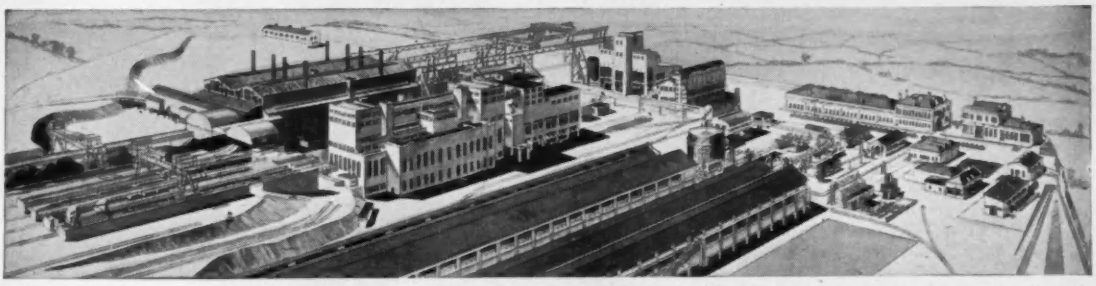
Medium Voltage Switchboard with "GEO" Circuit Breakers in the Retort Sub-station.

20 amp Direct-to-line Starter and Feeder Circuit Breaker with integral isolator and complete interlock.



For the new

Provan Gas Works . . .



Perspective Drawing by courtesy of the Main Contractors, Woodall Duckham Construction Co. Ltd.

Ellison Switchgear

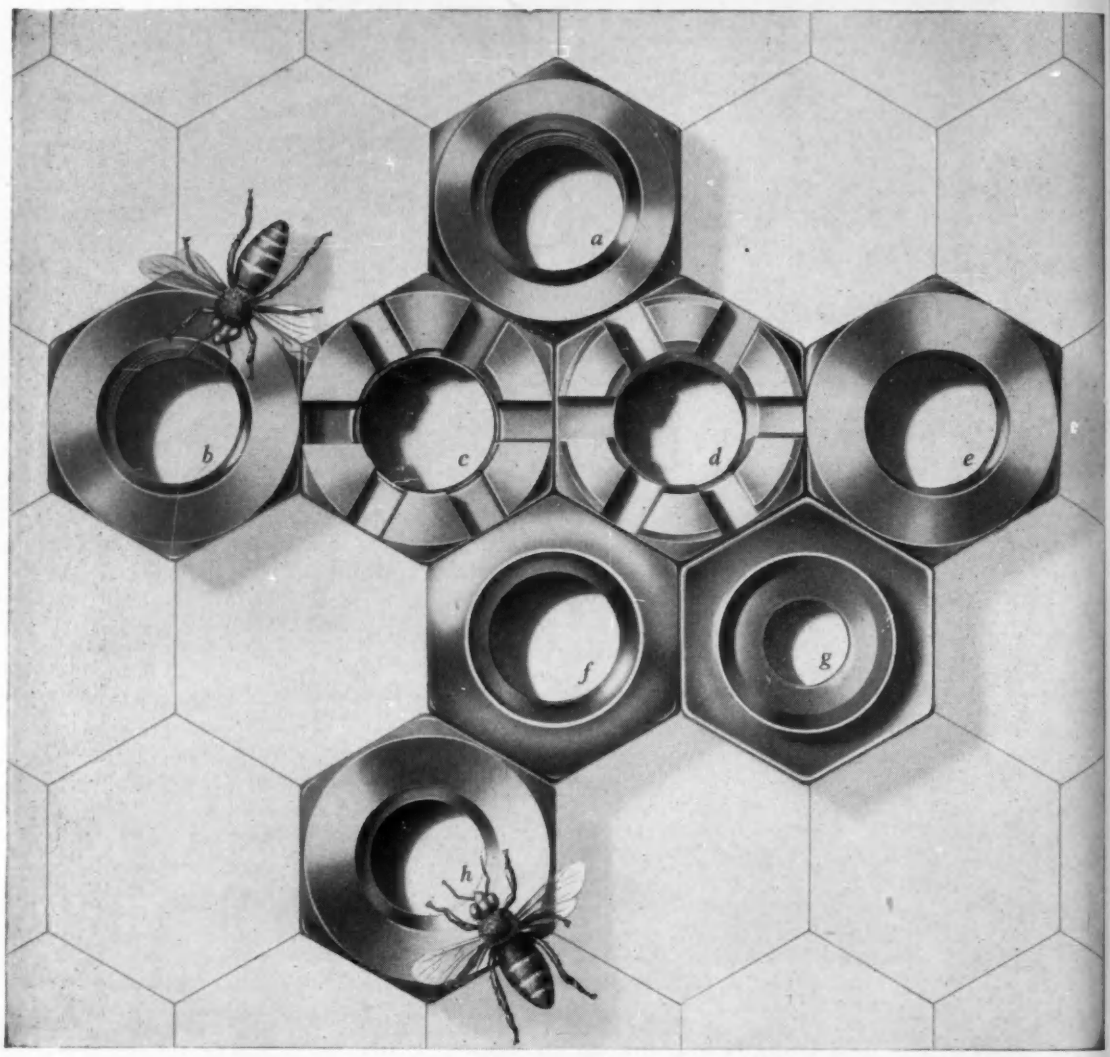
In the reconstructed Provan Works at Glasgow, the Scottish Gas Board has made extensive use of Ellison Switchgear. Some of the equipment is illustrated here. It includes four distribution switchboards as well as many circuit breakers and motor starters.

Rotor Starter for slip-ring induction motors. Available for motors of up to 1000 h.p.

GEORGE ELLISON LIMITED BIRMINGHAM ENGLAND

Continuing a Tradition

796



SIMMONDS MAKE NUTS FOR BUSY PEOPLE

Simmonds, the self-locking nut specialists, also make standard nuts faster than you can use them—bar turned and cold formed, in a wide range of sizes, steels and finishes. There are so many you can always get *exactly* the nut you want. If you need a special nut or turned part for a special job you can get that too. Just contact Simmonds.

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CIC36

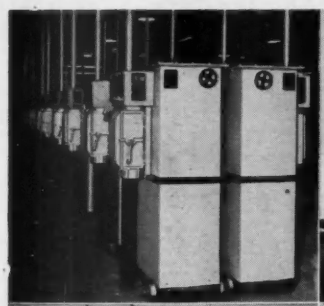
How Brentford Regulators help production and public services

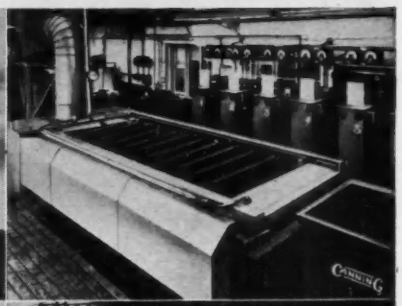
Brentford Voltage Regulators are used with outstanding success in a wide variety of industries and services. They provide efficient stepless on-load control for all types of electrical equipment. By ensuring smooth power control from zero to maximum, they provide the means whereby electrical equipment of all types, from furnaces to the most sensitive plant, can be operated at maximum efficiency and with appreciable economies in the life of components.

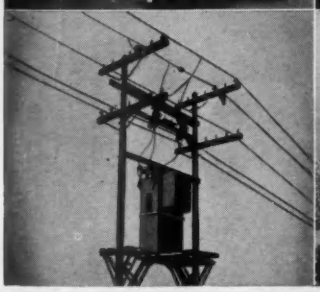
Sintering Furnaces
Brentford Regulators are used to provide temperature control within close limits.

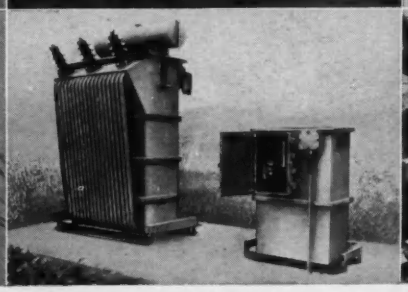
Airfield Lighting
Brentford Regulators, complete with remote control gear, are used to vary the brilliance of approach lighting. London Airport and R.A.F. Stations are equipped with these.

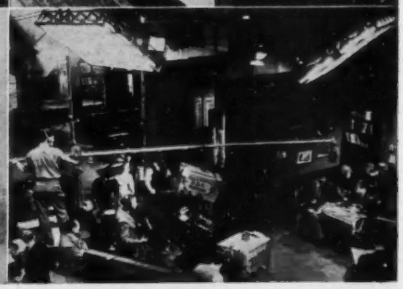
Electroplating
Universally chosen for electrolytic processes, Brentford Regulators have the robustness necessary for such applications. More than 5,000 in service in U.K. alone for up to 10 years.











Distribution Systems
For systems carrying a mixed industrial and domestic load and for the control of long, heavily loaded lines, Brentford Regulators are used throughout the world.

Radio, Television, Radar
Undistorted waveform output makes Brentford Regulators ideal for operation with sensitive plant. Used in all B.B.C. television and radio stations.

Brentford will supply the answer to your Voltage Regulation Problems. Write or telephone to :—

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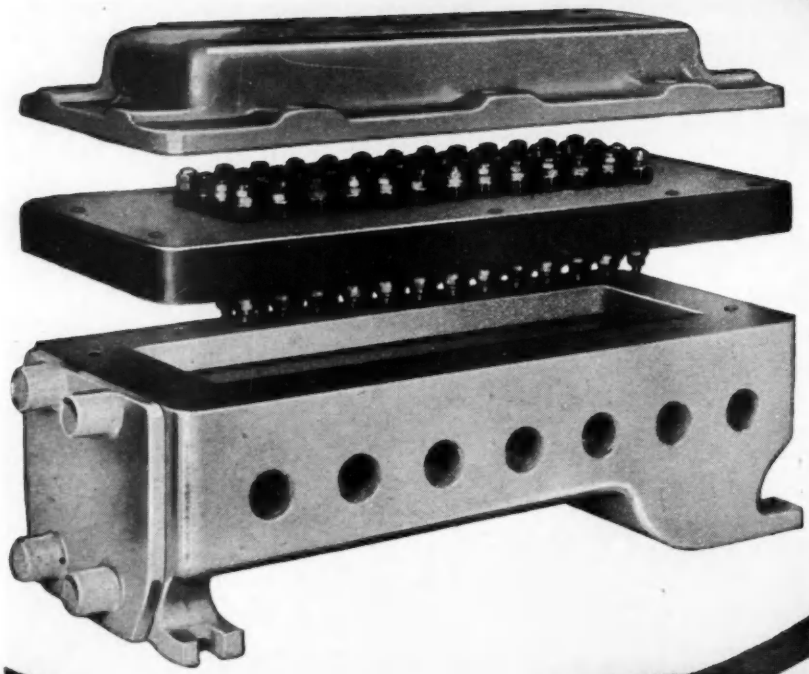
B

G.E.C. Terminal Distribution Boxes are designed for use in wiring installations where complex connections are involved in circuits up to 30 amperes at 440 volts. They fully comply with BS.229 and are available in the following types:—
CF 8011/A1 52—7½ amp. 250 v. terminals
CF 8011/A2 27—15 amp. 440 v. terminals
CF 8011/A3 12—30 amp. 440 v. terminals
Size: 13 in. x 5$\frac{5}{16}$ in. x 6½ in. deep;
Weight: 18 lbs.

flameproof...

weatherproof..



G.E.C.

terminal distribution boxes

Approved by The Ministry of Power for gases of Groups II and III.
Certificate FLP3468 (March 1955).

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Why do I use BICC cables...?

Well, for one thing their rubber and plastic cables are the easiest to work with that I know. They're nice and flexible to handle and easily stripped.

Their M.I. cables too — quicker and cheaper to install than conduit wiring; and there are a number of new tools to speed up and simplify the work.

Then, there's delivery. I've no room for large stocks, so I rely on my orders being delivered when I want them. That's where BICC score: branches everywhere; all well stocked — all ready to go!

whatever you want,

with a 43-branch network at your service

prompt deliveries of everything from

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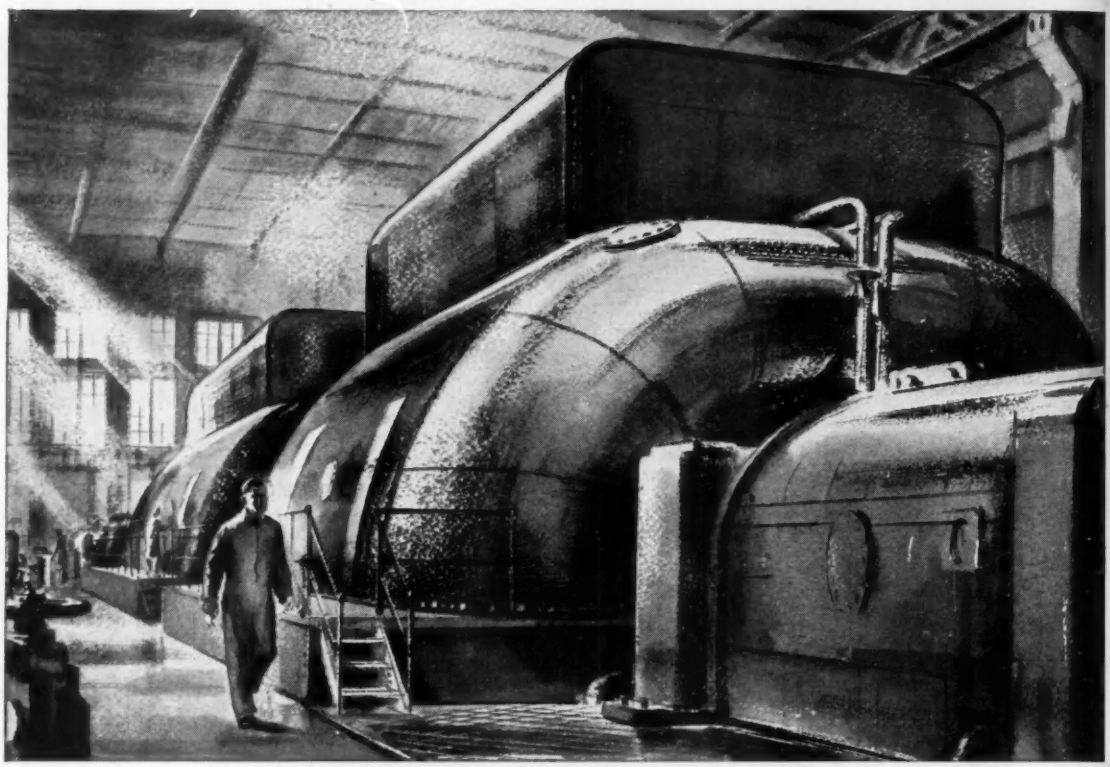
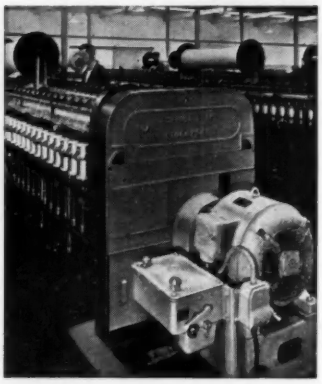


The world's largest Generators will help to fill the demand for still more power

Progress in the development of nuclear energy for generating electricity is still making front-page news —and rightly so. Spectacular advances are continually being made. Less publicised, though in their own field no less outstanding, are recent developments in the design of "conventional" generating plant. The turbo-alternator illustrated, for instance, is a 550,000 kilowatt unit—twice the capacity of the next largest generator now on order for the Central Electricity Generating Board. This machine has been designed for the projected new power station at Thorpe Marsh. For Blythe 'B', another new station, 275,000 kilowatt in-line units are on order. These sets will be served by unit boilers and will operate at steam conditions of 2350 lb. per sq. in. and 1050°F, with reheat to 1000°F.

Nuclear power stations will play an increasingly important part in meeting the doubled demand for electricity forecast for the next ten years. Construction work is progressing rapidly at the sites of the Board's first three nuclear power stations, at Bradwell, Berkeley and Hinkley Point. The aggregate capacity of these stations will be not less than 1,100,000 kilowatts; and by 1966/7 some 5 to 6 million kilowatts of nuclear-generated electric power will be available.

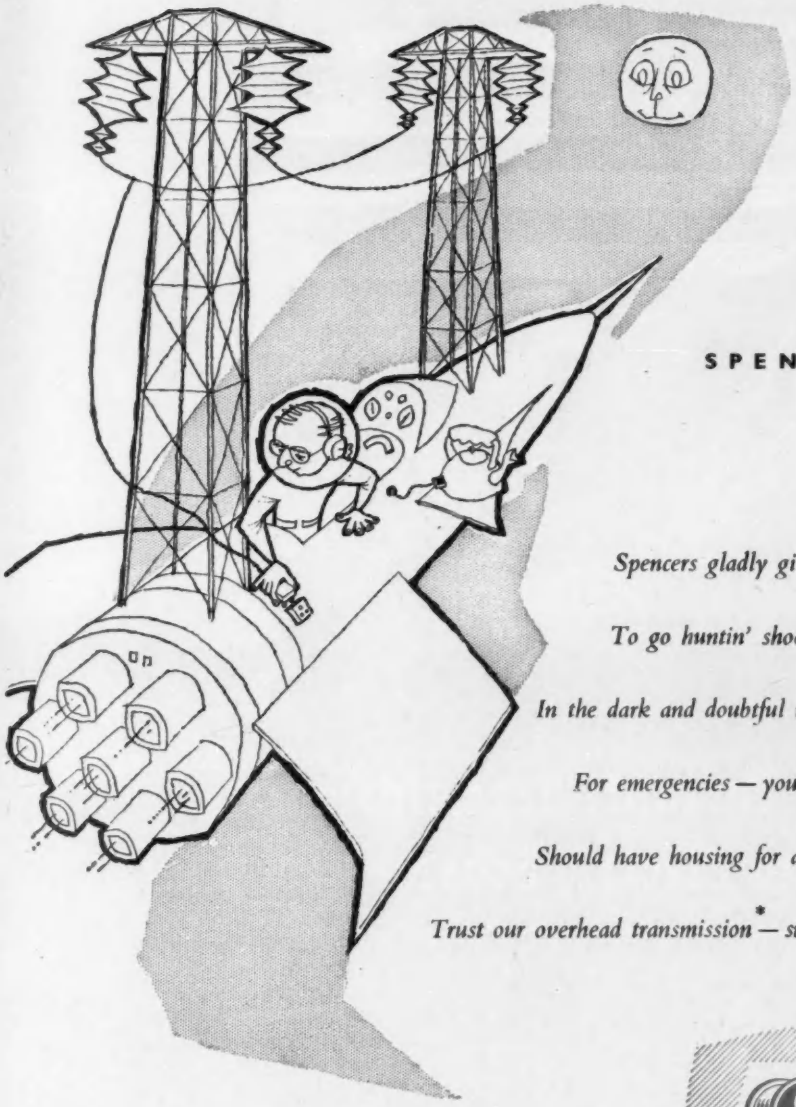


Though these are projects which will not be completed for some time, the work of the Central Electricity Generating Board is playing an important part in today's fight against inflation. Power stations are being built now at an overall cost no greater than in 1948—£50 per kilowatt installed. And, although the output capacity of the industry has doubled since 1948, the increase in manpower is only about one-third.

By providing today for the power we shall need in years to come, the Central Electricity Generating Board is building a secure foundation for our future prosperity.

THE CENTRAL ELECTRICITY GENERATING BOARD

CEGB



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Spencers gladly give permission

To go huntin' shootin' fission

In the dark and doubtful waters of the moon.

For emergencies — your rocket

Should have housing for a socket

Trust our overhead transmission — such a boon!*

Spencers OF WAKEFIELD

* SPENCER'S COPPER STRAND AND ALUMINIUM CONDUCTORS are being used for the carrying of electricity on overhead transmission lines and in many electrification schemes at present being carried out in the United Kingdom and overseas.

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5,337,333 kVA

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A STORY OF ACHIEVEMENT

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The Ferranti transformer factory at Hollinwood, Lancashire, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Voltage Regulators, High Voltage A.C. and D.C. Impulse Testing Plant and Specialised Equipment.

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FT 215/2

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For over thirty years Stream-Line filters have been recognised as the most efficient method of removing all traces of solid matter and moisture from insulating oil.
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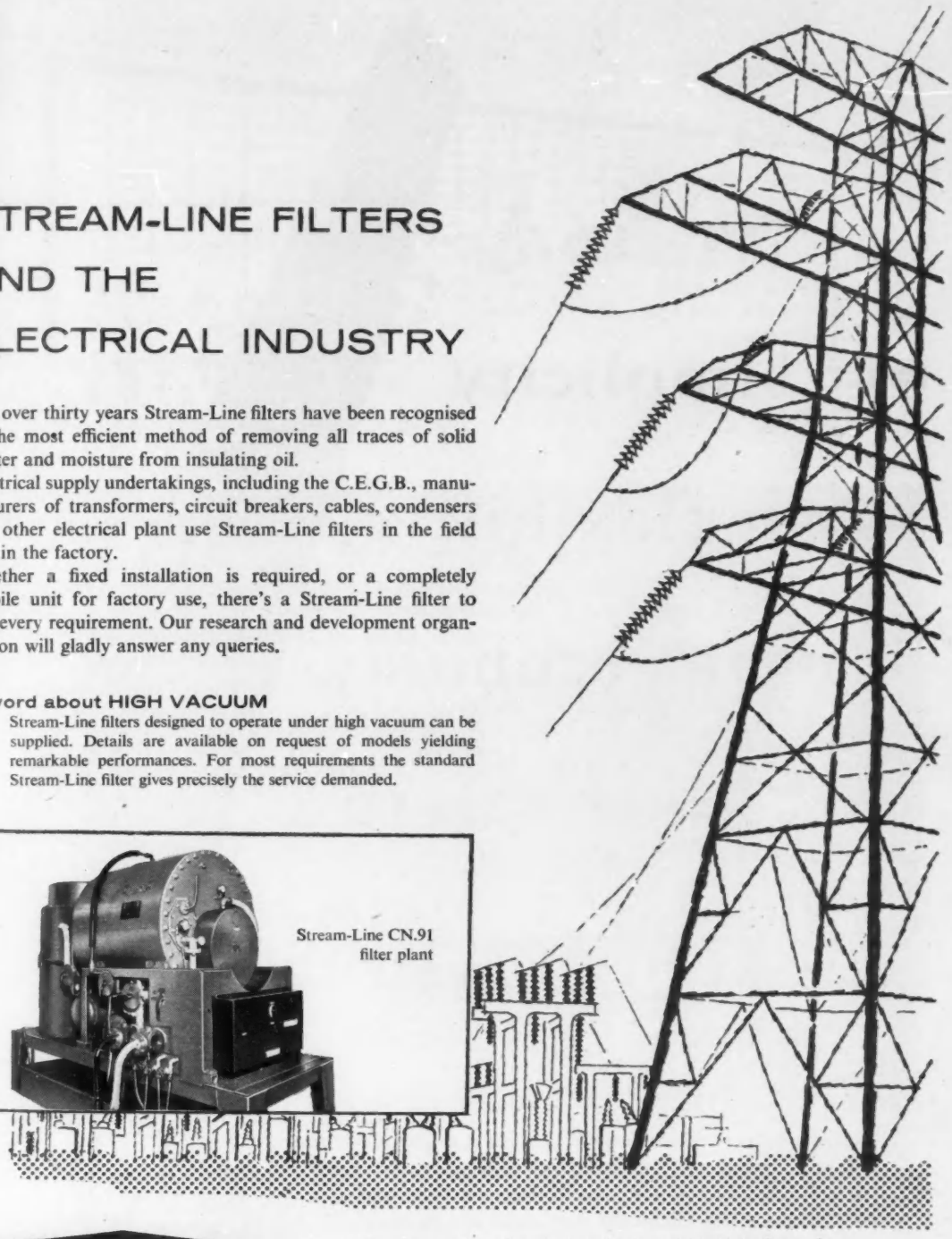
Whether a fixed installation is required, or a completely mobile unit for factory use, there's a Stream-Line filter to suit every requirement. Our research and development organization will gladly answer any queries.

A word about HIGH VACUUM

Stream-Line filters designed to operate under high vacuum can be supplied. Details are available on request of models yielding remarkable performances. For most requirements the standard Stream-Line filter gives precisely the service demanded.

Stream-Line CN.91 filter plant



STREAM-LINE FILTERS

Users of Stream-Line filters include the Central Electricity Generating Board, South of Scotland Electricity Board, North of Scotland Hydro-electric Board, Area Boards responsible for distribution in the U.K. and Electricity Undertakings throughout the world.

STREAM-LINE FILTERS LTD · INGATE PLACE · LONDON · S.W.8
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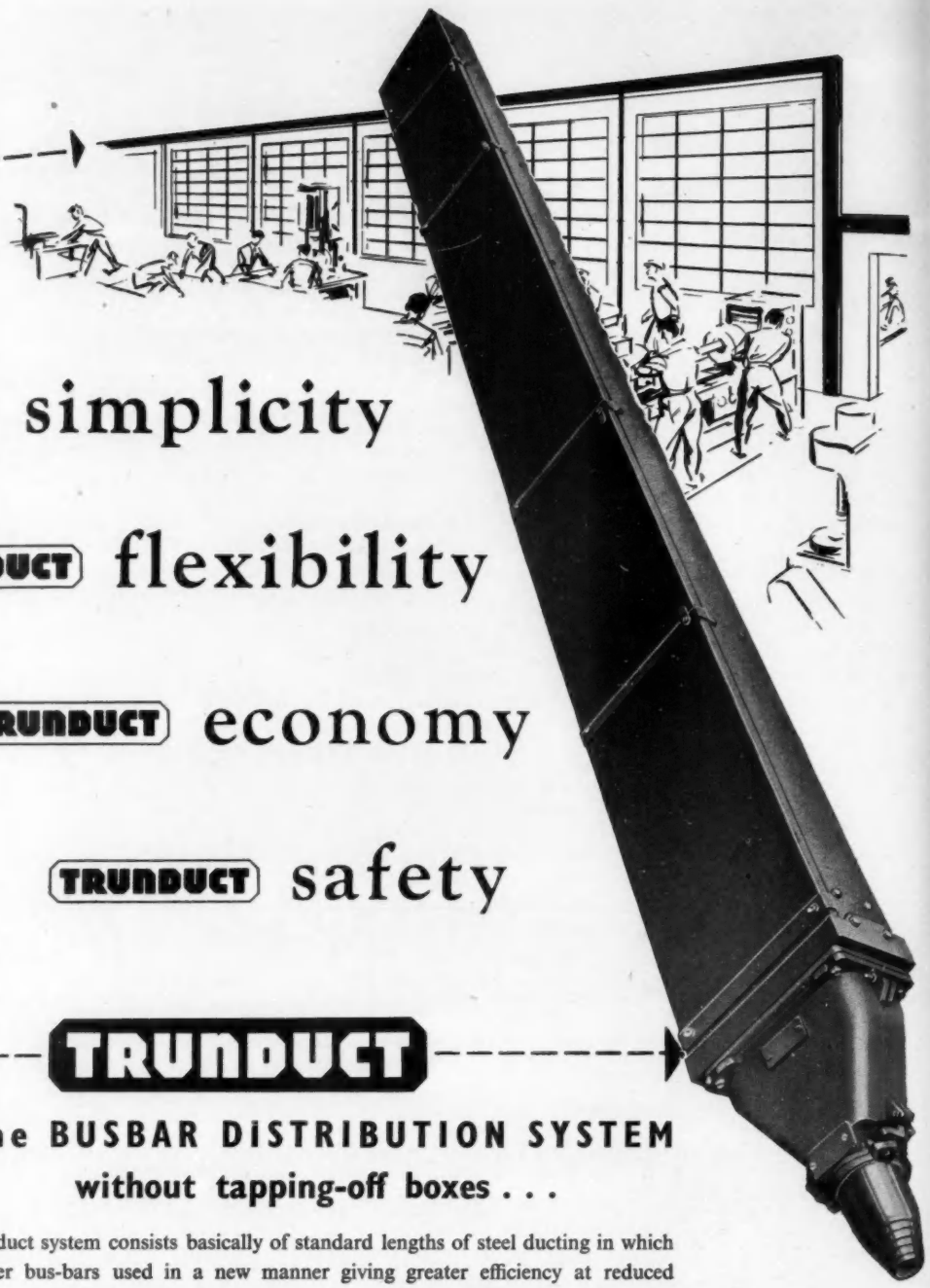

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TRUNDUCT flexibility

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The Trunduct system consists basically of standard lengths of steel ducting in which run copper bus-bars used in a new manner giving greater efficiency at reduced cost and in which, at regular intervals, there are fused tapping-off positions for branch circuits. The usual tapping-off boxes are dispensed with and the fuses controlling the branch circuits are housed within the ducting, plugging straight on to the busbars. This method eliminates one of the chief sources of contact and earthing troubles. Trunduct saves time and money on planning, ordering and installation.

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CVS—33

THEY SET A STANDARD

OVER 1500 years ago the Romans built the roads whose names are still familiar to us—Fosse Way, Watling Street, Icknield Way, Ermine Street and many others. Often following tracks old before the Romans came, these broad, straight roads provided vital communication for the legions, and for the administrators and merchants who followed in their steps. In road building, as in many other fields, the Romans set a standard which few have equalled since.

In cable making, too, standards are of vital importance. For over 100 years members of the Cable Makers Association have been concerned in all major advances in cable making. Together they spend over one million pounds a year on research and development. The knowledge gained is available to all members. This co-operation has contributed largely to the world-wide prestige that C.M.A. cables enjoy, and it has put Britain at the head of the world cable exporters.

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Roman legionaries on the march.

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* *C.M.A. Trade Marks for Mains Cables only*

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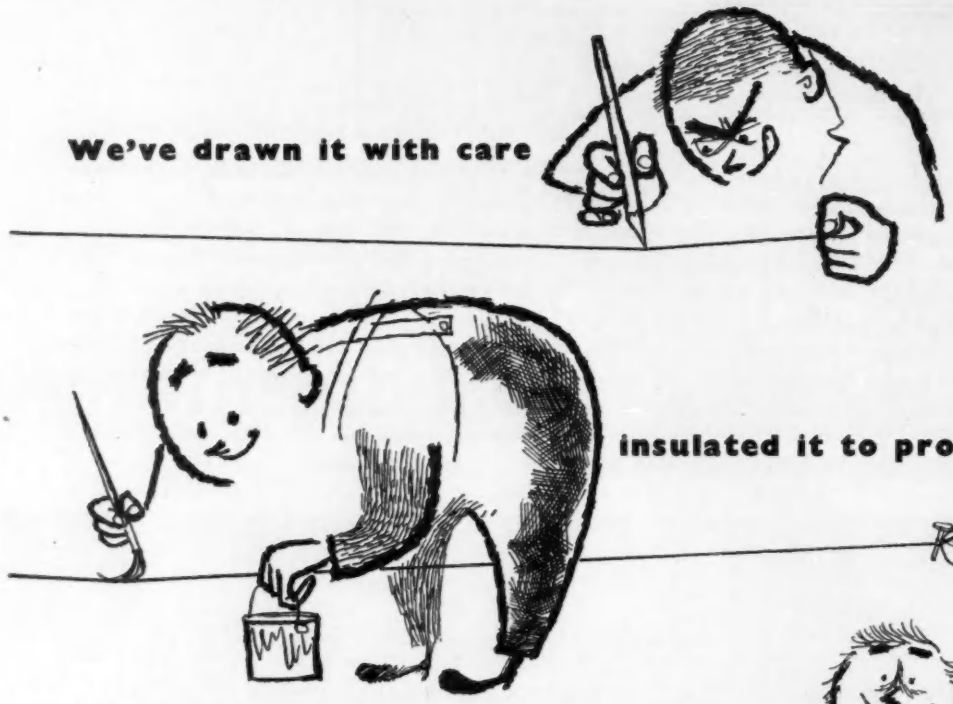

and our booklet tells you all about

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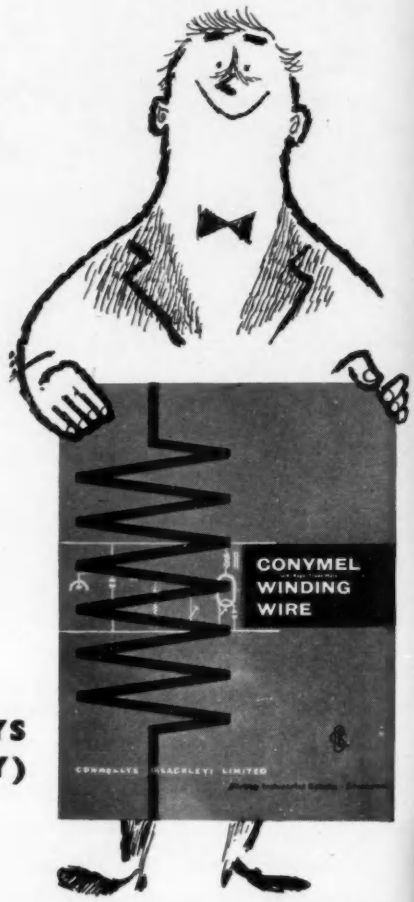
Conymel, an all purpose vinyl acetal base winding wire, has been developed for many applications where toughness of insulation combined with flexibility and resistance to the solvents in impregnating varnishes is essential. Our latest Conymel catalogue gives all possible technical information on this type of wire, and will be of the utmost assistance to Designers and Coilwinders. A copy will gladly be sent free of charge on request.



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with or without Isolator

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MODELS from our NEW RANGE

The others will interest you.
Why not get in touch?

AC Operated Electronic Timer (up to 5 minutes delay)
TYPE E/T

Automatic Control of multi-speed Pumps (operates from the level of the liquid)
SPECIAL EQUIPMENT

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Details of other types are available on request

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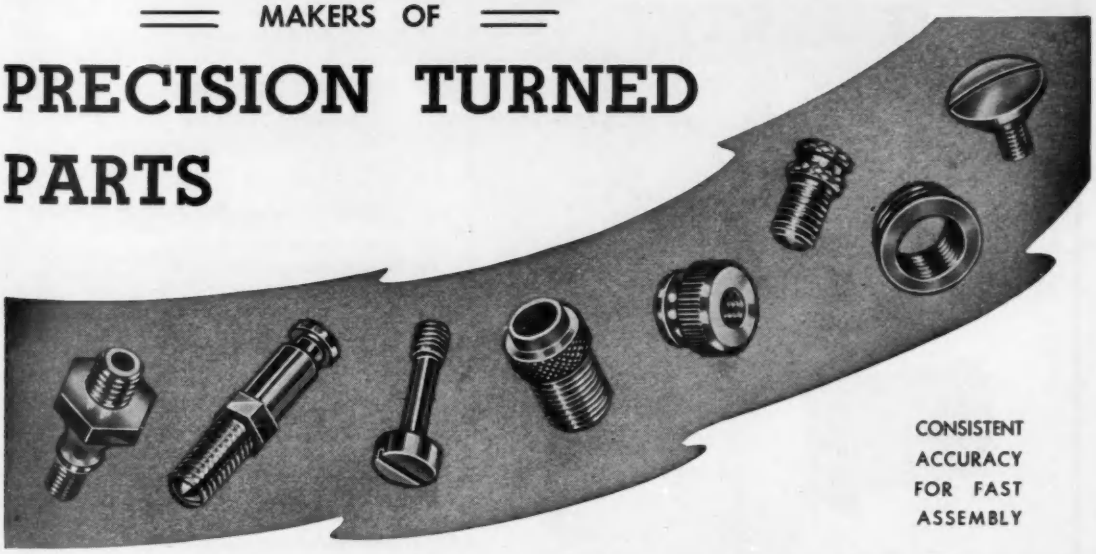

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AUTOMATIC AND CAPSTAN PRODUCTIONS

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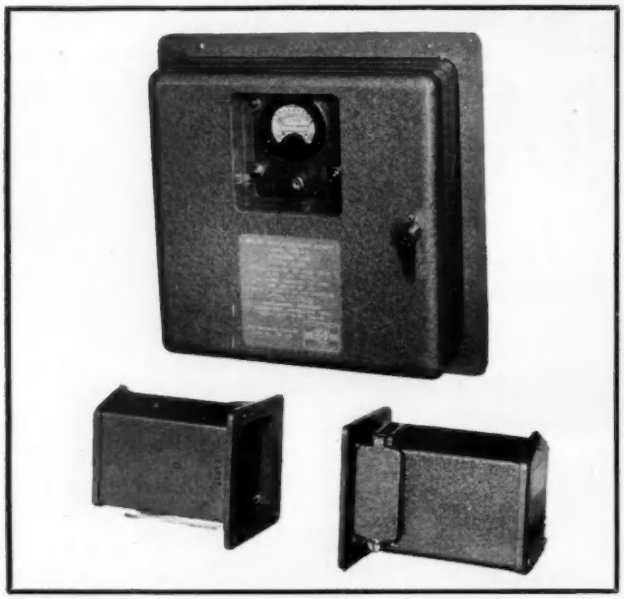
New Smoke Densitometer and Alarm complies fully with British Standards

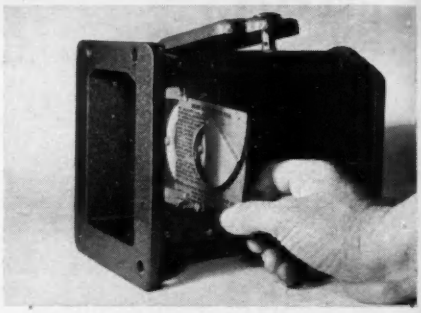
The Clean Air Act of 1956 calls for limitation of the emission of dark smoke (No. 2 Ringelmann or darker). This new Lancashire Dynamo smoke densitometer and alarm is not only an economical alarm unit which will ensure compliance with the Act but, by the addition of an indicator or recorder unit, it becomes a smoke densitometer for better combustion control and lower fuel costs.

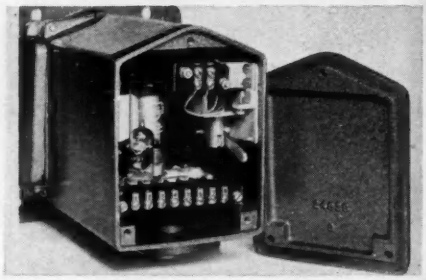
This equipment is the first of its kind to carry the British Standards Institution's "Kite Mark", which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument, with BS.2811/57.

Note these Features

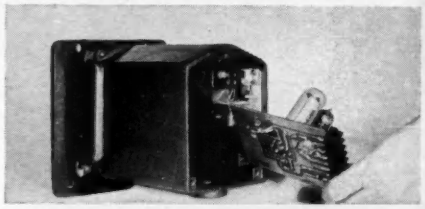
- **WEATHERPROOF CAST IRON HEAD UNITS WITH STAINLESS STEEL FITTING AND EASY ACCESS FOR LENS CLEANING.**
- **FULLY SERVO STABILISED LIGHT SOURCE PLUS "FAIL TO ALARM" CIRCUITS FOR CONSISTENT OPERATION.**
- **FULL RANGE OF ACCESSORIES INCLUDING CHIMNEY AND FLUE FITMENTS, INDICATORS, RECORDERS, ALARM BELLS AND HORNS, LENS CLEANING BLOWERS, SPECIAL CABLING AND MANY OTHERS.**

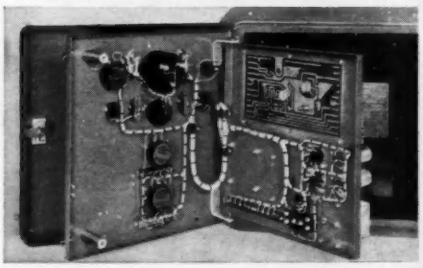






Calibration check by manual insertion of check slide or, in lower illustration of head with remote standardising unit, by push button from main unit.





Printed circuit in main unit and head for ruggedness. Head unit circuit easily removed without disturbing mounting of unit on stack.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LTD

ELECTRONIC EP EQUIPMENT

RUGELEY, STAFFORDSHIRE, ENGLAND

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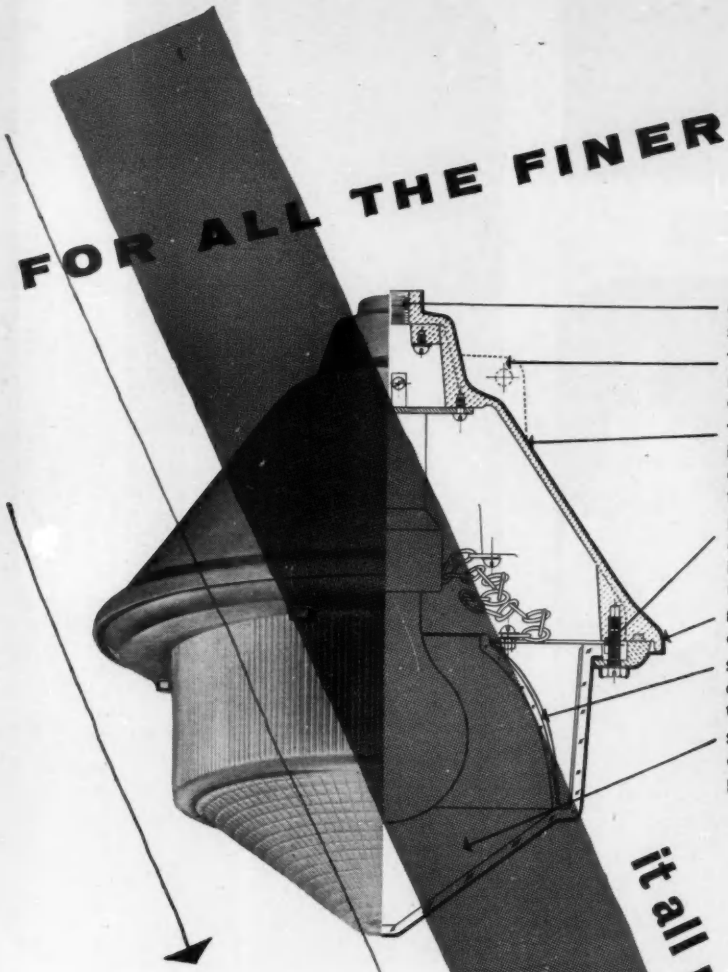

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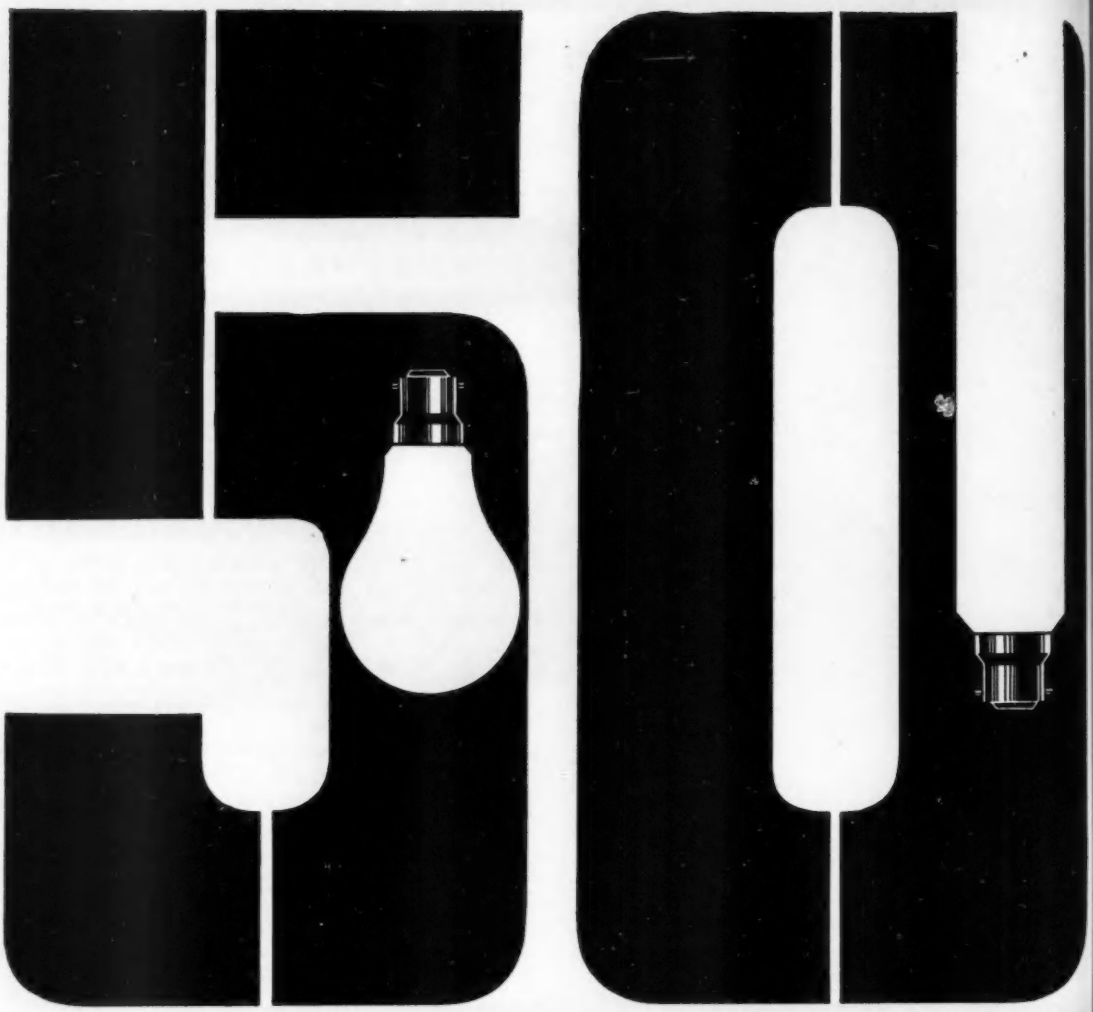

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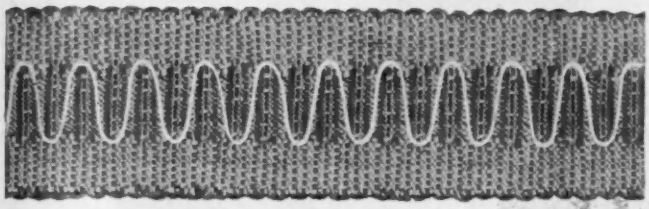

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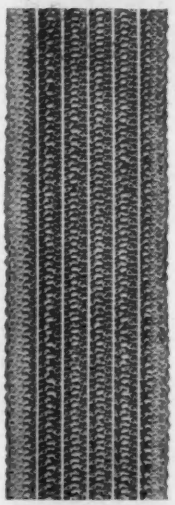

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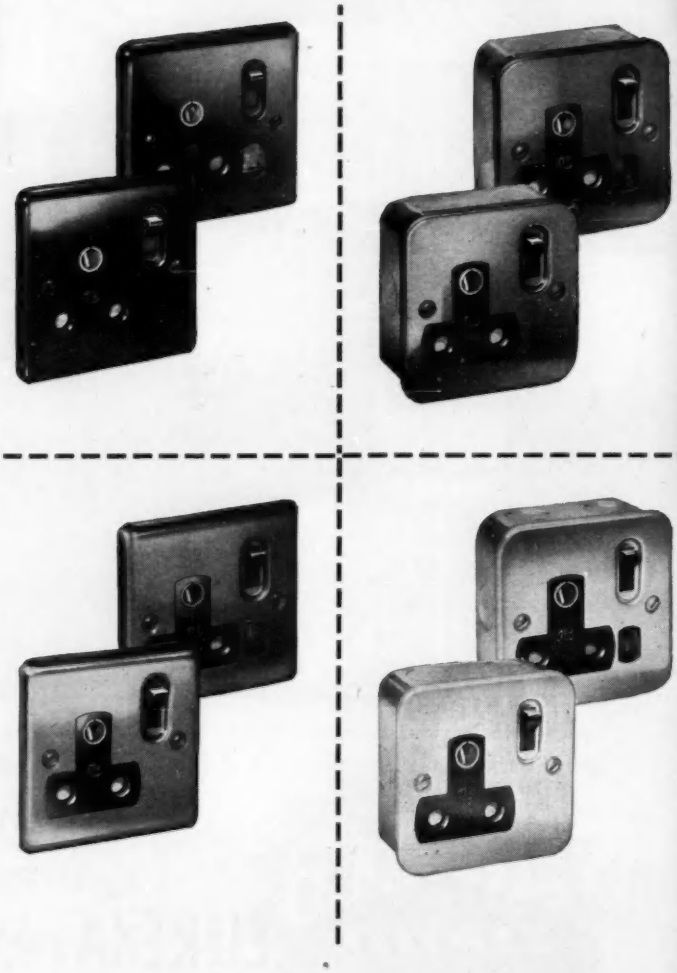

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FRIDAY
19 DECEMBER
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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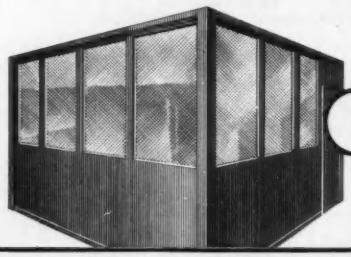

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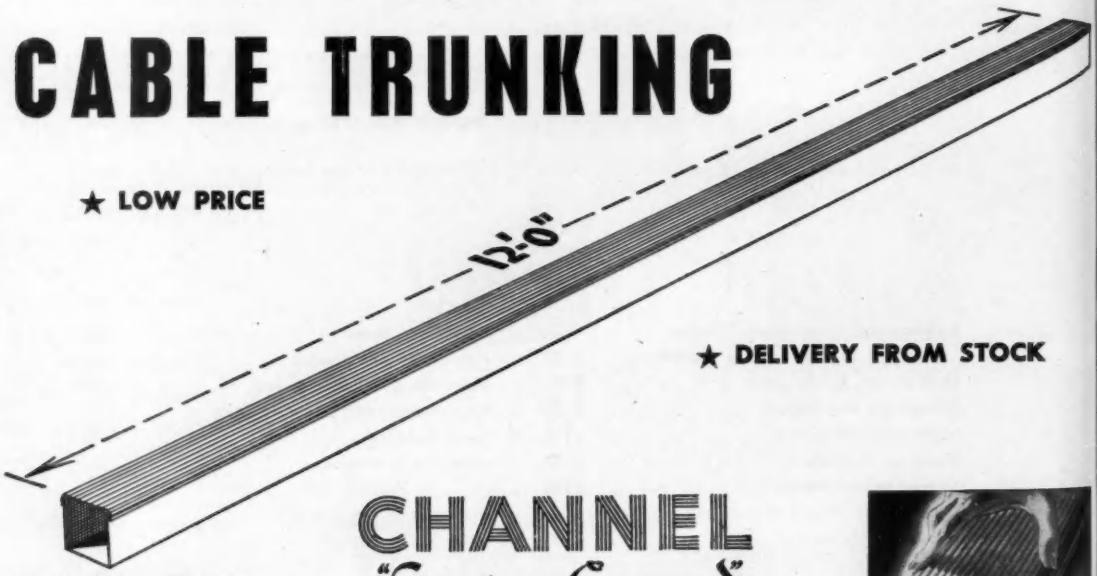

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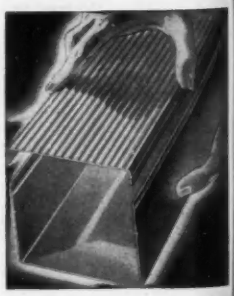

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ELECTRICAL REVIEW

19 December 1958 Vol. 163 No. 25 Established 1872

Hire-Purchase and Inflation

THERE are some very divergent views on the subject of hire-purchase. Some people, a diminishing number, hold it to be unethical and even dangerous. Others regard it as an extension to the public of the credit system upon which much of our economy is based. The public itself finds it a convenient way of acquiring goods for which, apparently, it is unable to save in advance: it is a method of saving in arrear, as it were.

The Government has found hire-purchase to be a flexible instrument for restricting or encouraging the public's expenditure (which is to be distinguished from public expenditure, i.e., expenditure by the Government and local authorities). This aspect was referred to by Mr. J. E. S. Simon, Financial Secretary to the Treasury, in his address to the Electrical Industries Club last week. Mr. Simon said that the Government had decided that its measures to prevent further inflation had so far succeeded as to make it possible to relax the restrictions. The relaxations lay in various directions and one in which immediate results were obtained was hire-purchase. There seemed to be a hint in Mr. Simon's remarks that the process would be quite as easily and quickly reversed if the necessity should arise. But he did say that the surge in hire-purchase business would gradually tail off and that early in the New Year it would run at a more normal level.

Although not in entire contradiction of this interpretation of the situation, views expressed a week or two earlier by Sir Ian Horobin, Parliamentary Secretary to the Minister of Power, varied somewhat from those of Mr. Simon. Sir Ian was somewhat perturbed at the hire-purchase rush and spoke of the danger of possible " raging inflation." He could not have had electrical appliances particularly in mind, although this was an electrical occasion, for generally speaking people buy these because they really need them and not just because they are made more easily obtainable. He hinted, however, as Mr. Simon did, that the movement could be checked by the restoration of hire-purchase restrictions. It is to be hoped that this will not be necessary. All such sudden changes are harmful to both manufacturers and distributors.

If excessive consumer credit turns out to be inflationary there are two factors which exacerbate the situation. The first, of course, is purchase tax. While ostensibly this " mops up " surplus funds in the hands of the public, it is a factor in the rising cost of living, leading to wage demands and the further ascent of the " vicious spiral." The second is the amount charged by finance houses for their accommodation. Much play is made with the 5 per cent per annum addition to the price of hire-purchased articles. As this addition is generally made to the original outstanding balance and repayment reduces that balance over the period, the actual rate of interest is always much higher.

Even in the case of bank loans it works out at 9 per cent, but a number of "industrial bankers" offer a return of up to 8 per cent to depositors, suggesting that their charges to borrowers are well in excess of this. Because they are able to offer more favourable terms, the Electricity Boards are accused of unfair competition. They obtain their finance more cheaply, of course, but if they do not run their hire-purchase business at a loss they are not vulnerable. Private traders should make a move against any onerous terms imposed by finance houses if they wish to do better.

THE RAILWAYS' FUTURE

Mr. Watkinson, the Minister of Transport, told the House of Commons last week that he had requested the British Transport Commission to conduct "a full, detailed and urgent review" of the railway modernisation plan. This would include a re-examination of the future course of the plan, with particular reference to the next five years, and a reappraisal of the economics of modernisation and the steps necessary to achieve the earliest possible "break-even" date.

What this actually implies is not yet clear. The Transport Commission is accelerating the introduction of main-line diesel locomotives and by 1961 nearly 1,100 will be in service; the 1955 plan envisaged about 2,500 in a maximum of 15 years. It is intended to concentrate resources on the electrification of the lines between London and Manchester and Liverpool "to accelerate its completion by many years." This, the Minister said, would not mean a stoppage of new electrification work now in progress, but surely some slowing-down is implied.

Is there a proper allocation of resources between "dieselisation" (the so-called "half-way house") and electrification? Should there not be a switch from the former to the latter rather than intensive development of both?

"TOP-HAT" CERAMIC KILNS

Hitherto, ceramic products have generally been baked in coal-fired kilns which have many disadvantages, not the least of which are the dirt, dust and smoke produced in the process. A novel form of an electrically fired kiln has been developed and produced by Shelley Electric Furnaces, Ltd., and is described in this issue. The implementation of the Clean Air Act has meant that serious consideration has had to be given to "clean" methods of firing so that the recent introduction of the "top-hat" kiln has come at a very propitious time. The products to be fired in this kiln are built up on a special base and the kiln is lowered over the top. The products are therefore not subject to any movement as is the case with the tunnel and truck kilns. Other advantages are that there is a complete heat seal and a specific cooling cycle can be obtained by a controlled lifting of the cover. Because the kiln itself and the associated bases are movable and the oven is therefore not classed as fixed plant, the equipment is not liable to rating or Schedule A assessment. This represents a substantial saving in overhead costs.

Many ceramic items require a 12-hour baking period only. In this case the products can be assembled on the bases during working hours and fired at night at off-peak electricity rates. With programme control apparatus the baking cycle can be automatically controlled and only one man is required for the night shift to tend all the kilns in a factory.

ELECTRICITY SUPPLY SCHOLARSHIPS

Particulars of university scholarships for sixth-form students, enabling them to read for engineering or science degrees, were announced last month by the Electricity Council. As many as sixty can be awarded annually by the Central Electricity Generating Board (25) and the Area Electricity Boards (up to three each).

When the scholarships were mentioned at a meeting of the National Joint Advisory Council they were welcomed by the Electrical Power Engineers' Association and the other trade unions concerned but with the qualification that present employees should be given equal consideration for such educational opportunities. There are already scholarship schemes for those within the industry but an assurance was given that these would be modified and improved so as to ensure that anyone on the staff with the necessary preliminary requirements would not be held back.

This is as it should be, for although the candidates from outside may elect to stay in the industry after the two years specified in the terms of the scheme, it is more likely that those already employed in electricity supply will remain in it and raise the general standard.

DESIGN IN INDUSTRY

When questions of personal taste are involved, as in the outward appearance of electrical equipment, discussion is likely to be both heated and inconclusive. It was therefore wise as well as more instructive that at the recent conference on "Industrial Design in the Engineering Industries" attention should have been given not only to appearance but also to the many other ways in which an industrial designer can help to make a product more attractive to the user and more profitable to the manufacturer.

Although regarded by some with suspicion, industrial designers are being increasingly employed with success by manufacturers of both domestic and heavy equipment who realise the value of well-designed products in expanding business at home and abroad. In the domestic field the Council of Industrial Design have been helped in the promotion of their ideas by the success of the Design Centre. Such an arrangement is not practicable for larger equipment, but the staging of suitable displays, even if only of photographs, at some of the engineering exhibitions would bring home to more people what is meant by good design, and stimulate criticism along the right lines.

We wish all our readers a Happy Christmas and success during the Coming Year

Magnetic Amplifier Voltage Regulation

ALTERNATOR STABILITY TESTS AT POOLE POWER STATION

A major recent development is a magnetic amplifier voltage regulator of the continuously acting type. It is capable of controlling the largest alternators and will require little or no maintenance since it is static. Equipment of this type has been installed by the G.E.C. at Poole generating station in conjunction with one of their 60 MW direct cooled turbo-alternators. This article describes the equipment and also the extensive operational stability tests carried out

THE construction and commissioning of the 275 kV supergrid and the continued increase in the size of individual generating units which will be directly connected to it has focused attention on the problems which may arise in day-to-day running, one of these being the stability of operation on leading power factor loads. Up to a few years ago this condition would have required alternators to be designed with a relatively higher short-circuit ratio (s.c.r.) and therefore with an inherently greater capacity to supply leading MVAr with a reasonable margin on the steady-state stability limit corresponding to a rotor load angle of 90 deg.

The development of the quick response automatic voltage regulator (a.v.r.) with no dead band has provided another solution to the problem since it permits satisfactory operation at rotor load angles over 90 deg, i.e. in the dynamic stability region. It is then possible to reduce the s.c.r. and to use the margin in rotor excitation so obtained to increase the capacity to supply lagging MVAr, i.e. to reduce the rated power factor to a value more suited to system conditions.

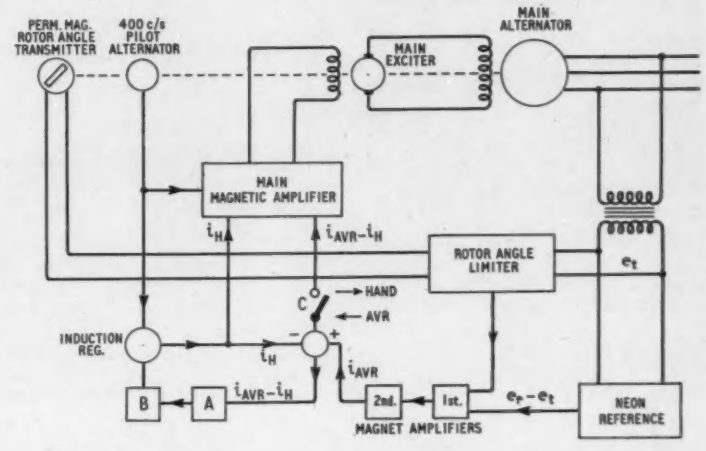
It is essential that the performance and reliability of the a.v.r. equipment should be of the highest order with maintenance reduced to the minimum. The General Electric Co., Ltd., has had many years' experience of the application of large magnetic amplifiers in the automatic control of industrial equipment such as colliery winders and rolling mills and also in the design of high sensitivity, quick response voltage regulators for special alternators. A major recent development is a magnetic amplifier voltage regulator of the continuously acting type capable of controlling the largest alternators and requiring little or no maintenance since the regulating equipment is static. From the schematic diagram (Fig. 1) it will be noted that the usual d.c. pilot exciter is replaced by a 400 c/s homopolar alternator. This high frequency supply feeds the magnetic amplifiers and gives a high speed of response for the a.v.r. static equipment.

Three magnetic amplifiers connected in cascade feed directly the main exciter field with a current proportional to the error between the terminal voltage and the set reference voltage. An important feature of the regulator is the inclusion of an automatic over-riding control, responsive directly to the rotor load angle, which under any loading condition will prevent the excitation from being adjusted to such a value that the preset maximum rotor angle can be exceeded.

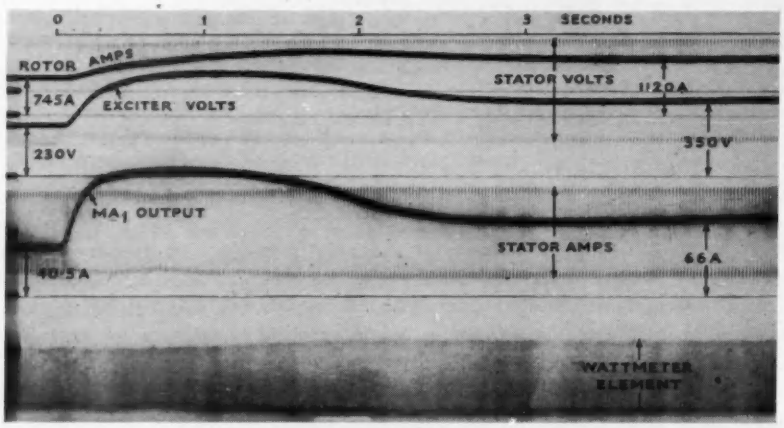
Some informative results have been obtained from an extensive series of tests recently carried out on a regulator of this type controlling a 60 MW direct-cooled turbo-alternator installed by the G.E.C. in the Poole generating station of the Southern Division of the Central Electricity Generating Board. Many synchronous and asynchronous running tests were made to examine the behaviour of the regulator under different conditions and to check its performance under rotor angle control instead of terminal voltage control. The opportunity was also taken to obtain data on machine characteristics not normally available, such as the measurement of the quadrature-axis synchronous reactance, running the machine as an induction generator with several field circuit connections, and performance under conditions of coarse synchronising. Analysis of the many oscillographic records will take some time, but it is possible to make some preliminary comments on a few of the more interesting results.

The response of the excitation system to a sudden change of voltage setting is shown in Fig. 2, where the

Fig. 1.—Basic diagram of automatic voltage regulator type C.V.R.7 with rotor angle limiter type K.A.L.



A.—Hand follow-up circuit. B.—Hand control induction regulator motor. C.—Hand/auto changeover relay. et.—Terminal voltage. er.—Reference voltage. iAVR.—Regulator control output signal = K (er − et). iH.—Hand control signal



	Initial Readings	Final Readings
MW	62·24	61·28
MVAr	1·0 lag.	43·6 lag.
Stator voltage ...	11·2 kV	12·3 kV
Stator current...	3,200 A	3,568 A
Load angle ...	66 deg	40 deg

Fig. 2.—Transient step change of regulator voltage setting

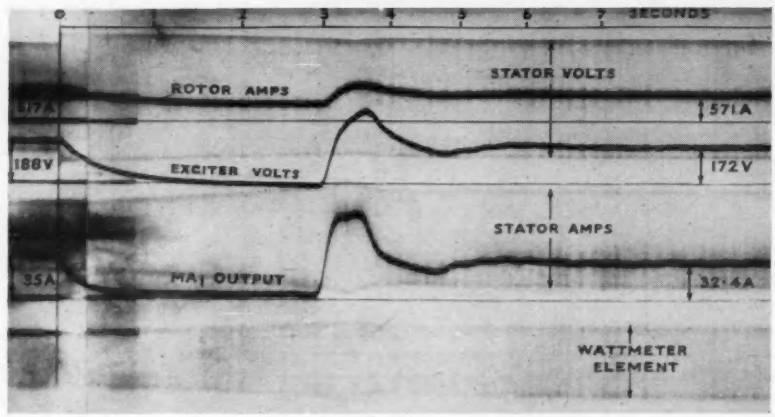
change of signal was such as to alter the generation from 60 MW unity power factor to 60 MW, 45 MVA lag (i.e. 0·8 p.f.). The rapid rise of the main exciter field current indicates clearly the high performance obtained from the 400 c/s magnetic amplifier chain. The terminal voltage reached its final value well within 2 sec. The initial dip in the terminal voltage trace was caused by a change of sensitivity applied to this trace as an indication of the instant when the transient kick was applied to the regulator.

Rotor Angle Limit Control

The rotor angle limiter is a continuously acting device whose operation may be considered equivalent to that of a stiff spring-loaded buffer, so that if the rotor tends to move beyond the set angle a signal proportional to the excess angle is applied to the a.v.r. to boost the excitation and prevent further increase of angle. This was demonstrated with the unit on 60 MW by adjusting the rotor angle limiter to 70 deg and then reducing the a.v.r. setting until the rotor angle approached this value, when the limiter began to have some effect. The first action was to bring up the rotor angle alarm. Subsequent reduction of the a.v.r. setting down to the minimum had little effect on the terminal voltage and rotor angle. The alternator excitation was now completely determined by the rotor angle limiter equipment and by altering the adjustment of the limiter, the alternator could be moved round to any load angle within the range of stable operation under normal a.v.r. control. In effect, this meant that the alternator was on rotor angle control instead of voltage control.

Tests were then conducted to determine the ability of the limiter to prevent a machine falling out of step under adverse transient conditions. One of these tests was to start with the alternator running at a normal load angle at 60 MW and suddenly to reduce drastically the a.v.r. setting giving a resultant zero field voltage on the alternator. Under these conditions the rotor angle limiter invariably provided a "buffer" to the rotor as it attempted to fall out of step, and correctly held the machine on the limiter equipment. An example of this is shown in Fig. 3.

A further interesting example of a practical application of this is shown in Fig. 4 where the rotor angle limiter has prevented loss of synchronism due to the line switching disturbance described below. This



	Initial Readings	Final Readings
MW	61·2	61·04
MVAr	20·1 lead.	56·0 lead.
Stator voltage ...	13·0 kV	11·93 kV
Stator current...	2,850 A	3,955 A
Load angle ...	66 deg	107·5 deg

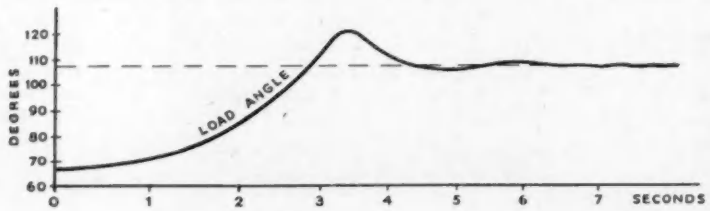


Fig. 3.—Rotor angle limiter preventing instability after a sudden step reduction of the regulator voltage setting

demonstrates that if a set is running at a high angle near the stability limit, the rotor angle limiter can ensure that no adverse system switching will cause the machine to fall out of step. It will be noted that the final steady-state load angles of 107·5 deg in Fig. 3 and 109·5 deg in Fig. 4 are substantially beyond the earlier theoretical limit of 90 deg, i.e. well inside the dynamic stability region.

Effect of Line Switching Disturbance

A reactor was available which had a reactance equivalent to approximately 50 miles of 132 kV overhead line. Tests were made to study the response of the a.v.r. to sudden insertion and removal of this reactor in direct series with the generator-transformer unit. It was found that when the alternator was running on a.v.r. control at a high machine angle, the sudden insertion of the reactor led to a reduced angle of generation and a greater stability margin and, conversely, the sudden short-circuiting of the reactor caused an increase in the angle of generation and loss of stability if the initial angle was too high. This is directly contrary to the known effect on normal hand-excitation control.

Tests were made, starting at 100 deg rotor angle generating 60 MW with the reactor in circuit and then shorting out the reactor with and without the rotor angle limiter in service. With no limiter, the set immediately fell out of step and resulted in the most severe system disturbance experienced during the whole series of tests. With the limiter in operation, stability was easily maintained as mentioned earlier with reference to Fig. 4.

Completely stable operation was obtained when generating 60 MW, 66 MVAr lead at a terminal voltage of 11·25 kV. This gave a transmission angle between the direct axis of the machine and the 132 kV station bars of 120 deg, representing a steady-state limit well beyond that likely to be required in practice. The addition of ±5 per cent current compounding caused a variation of ±3 deg in the absolute stability limit.

Synchronising on A.V.R. Control

Tests were made to determine how the machine would pull back into step on a.v.r. control once pole slipping had started. To do this the automatic hand control follow-up equipment was disconnected, and the hand control induction regulator moved to the zero field position while the set was running on a.v.r. control. To initiate the test, the machine was switched to hand control, resulting in zero alternator field voltage. After several seconds of pole slipping the set was restored to a.v.r. control when invariably the machine pulled back into step even on 60 MW governor setting.

The main reason for this is that during pole slipping the terminal voltage drops so low that the a.v.r. receives a continuous signal for peak forcing excitation. This produces a powerful resynchronising effect, the result

	Initial Readings	Final Readings
MW	58·72	58·8
MVAr	31·4 lead.	57·6 lead.
Stator voltage ...	11·45 kV	11·88 kV
Stator current...	3,330 A	3,960 A
Load angle ...	95·5 deg	109·5 deg

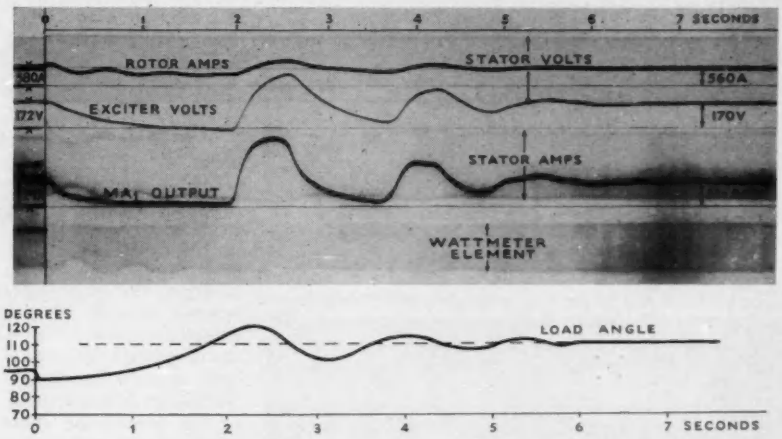


Fig. 4.—Rotor angle limiter preventing instability after line switching disturbance

	Initial Readings (before removing field)	Final Readings
MW	60·64	58·0
MVAr	33·5 lead.	0·7 lead.
Stator voltage ...	11·05 kV	12·12 kV
Stator current...	3,600 A	2,750 A
Load angle ...	94·5 deg	59 deg

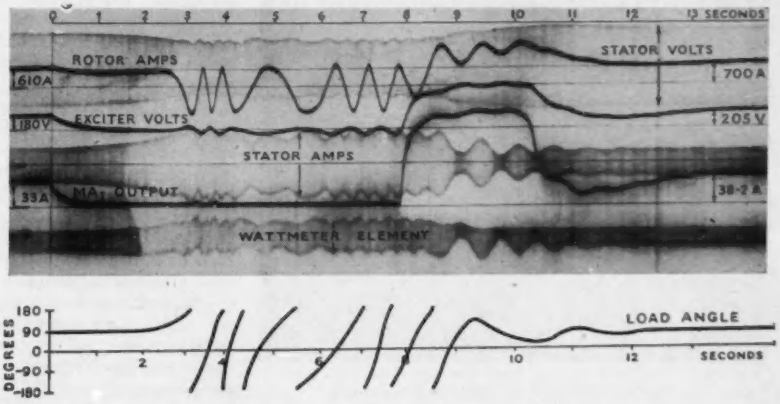


Fig. 5.—Restoration of synchronism by switching to a.v.r. control after removal of field at 60 MW

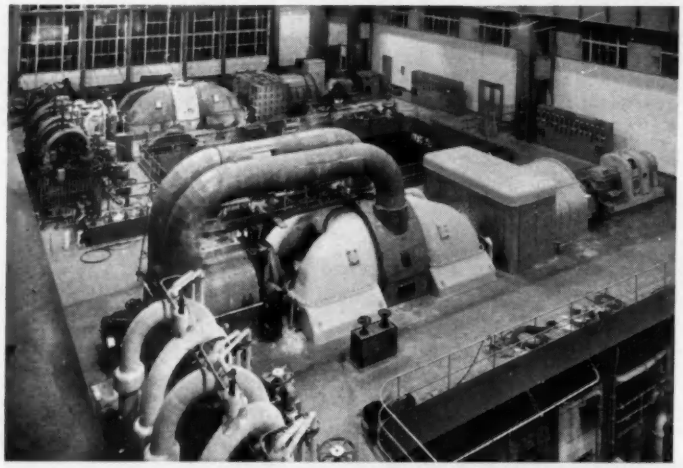


Fig. 6.—General view of the extensions at Poole showing in the foreground the G.E.C. 60 MW set on which the tests were made

being clearly seen from the oscillogram in Fig. 5. The addition of the extra series reactor did not alter this performance.

Field Switch Opening on Load

Tests were made by running the set on hand control at various power loads at unity power factor, opening the main field switch and reclosing it several seconds later. Results showed that up to 45 MW, resynchronising took place without altering the excitation setting, but above this figure an increase was necessary to pull the machine back into step. This applied generally to tests with and without the field discharge resistance in circuit and also with and without the extra series reactor.

The alternator is a 60 MW machine with direct rotor cooling and the first to be commissioned in Britain designed to operate at a hydrogen pressure of 30 p.s.i. The physical size of the unit is much smaller than that of a conventionally cooled machine of the same rating. The gear-driven exciter runs at 1,000 r.p.m. with an overhung 400 c/s homopolar alternator to supply the a.v.r. equipment. Since there is no other rotating plant the total amount of brushgear is reduced to the minimum of the exciter armature and the alternator rotor slip-rings.

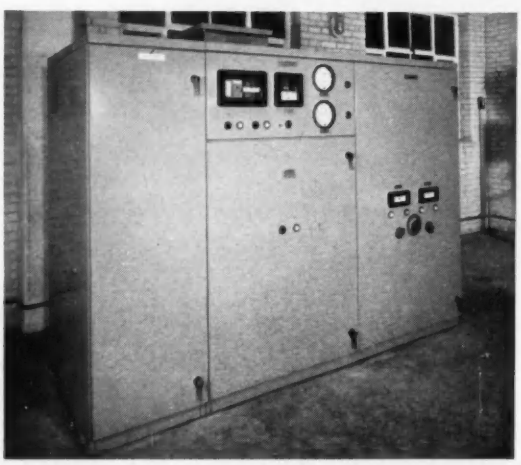


Fig. 7.—Combined a.v.r. and field suppression cubicle

The voltage regulator is a type C.V.R.7 magnetic amplifier continuously acting regulator employing a double neon reference tube circuit for high reliability and accuracy. The voltage error is amplified by two primary amplifier stages and controls a final magnetic amplifier of 12 kW peak output for supplying the field of the main exciter. The overall gain is such that the terminal voltage is regulated within 0·5 per cent of the set value. A fixed negative bias field is supplied to the exciter to improve the voltage bucking performance of the equipment.

The rotor angle limiter type K.A.L., incorporated as a standard feature, receives its signal from a permanent-magnet alternator on the shaft, so that an accurate indication of the rotor angle is obtained both during steady state and transient conditions. Once the set rotor angle has been exceeded, a strong boosting signal proportional to the excess angle is applied to the amplifier chain of sufficient gain to convert the equipment virtually into a rotor angle controller.

On hand control an induction regulator is used to adjust the signal winding of the main magnetic amplifier. On automatic control, the same regulator follows up the a.v.r. excitation setting so that a rapid change-over back to hand control can always be made without disturbance.

The over-riding principle has been to design a static regulator system with the greatest simplicity and reliability.

Measurements and Recordings

Oscillographic records were taken of machine terminal voltage, stator currents, MW and MVAr output, rotor current, exciter voltage and field current, rotor angle, speed, governor travel and input steam pressure. The initial and final values of most of these quantities were recorded by sub-standard instruments specially calibrated and installed for the tests by the Metering Section of the Technical Department of the Southern Division.

The rotor angle indicating instrument installed in the control room, and forming part of the normal a.v.r. equipment, is scaled 0-160 deg. A second instrument was provided to indicate the overall transmission angle between the rotor and the 132 kV busbars, and both meters agreed in general to within 1 deg with readings taken by stroboscopic shaft equipment. This equipment, developed and operated by the London Division of the C.E.G.B., provided recordings and a running commentary which considerably facilitated the control of many of the tests.

Altogether over 70 tests were made during the week, and a great proportion required initial and final readings, plus a transient record. Full evaluation of the records will give valuable new insight into the performance of synchronous machines under many unusual conditions and methods of control.

Acknowledgment is due to the C.E.G.B. for permission to carry out the tests and making all the necessary system preparations and protective gear setting arrangements, and also to Messrs. Merz & McLellan for their assistance.

Stroboscopic Resonance Testing

DETERMINATION OF THE VIBRATION FREQUENCY OF ELECTRICAL AND ELECTRONIC COMPONENTS

THE problem of vibration is one of growing concern in modern technology, as ever more power is extracted from machines which become smaller and therefore lighter. Electrical and electronic components are affected perhaps more than most, partly because they are relatively delicate, and partly because their vibration may result in secondary effects which are far more serious than the mechanical vibration which gives rise to it.

Generally speaking, it is fairly simple to make components strong enough to withstand applied vibration so that, for example, they will not fail by fatigue. A special condition arises, however, when a vibration happens to coincide with the natural frequency of any part. If this occurs in one of the electrodes of a radio valve, not only will this be subject to premature failure, but it may result in a spurious signal which can have serious effects upon the performance of the whole unit.

In the development of electrical equipment it is essential to ensure that no important part will resonate in sympathy with those vibrations likely to arise in its working environment. A vibration testing apparatus based on the principle of the stroboscope is illustrated in Fig. 1. At the front, a prototype radio valve is shown mounted on an electromagnetic vibrator which generates mechanical vibration over a wide range of frequencies when excited by a variable-frequency oscillator. The equipment behind it, the Type 1206A slow-motion stroboscope, is made by Dawe Instruments, Ltd., 99, Uxbridge Road, London, W.5. The case at the left contains a variable frequency oscillator with a range of from 10 c/s to 500 c/s, the upper figure being equivalent to 30,000 r.p.m. This embraces the majority of mechanically induced forms of vibration.

The oscillator provides two separate outputs. One, at the frequency indicated on the manual tuning dial on the front of the oscillator, is fed to the vibrator. The second output is modified by a motor-driven frequency-shifter which can be adjusted so that the output frequency differs from that fed to the vibrator by anything between ½ c/s and 2 c/s, regardless of the main frequency setting. This second signal is used to trigger the stroboscope seen at the centre, which has a flash duration of between 15 and 40 microseconds—sufficiently brief to "freeze" the most rapid mechanical motion. The unit at the right supplies the power to drive the equipment, and amplifies the signal to the vibrator.

Study of Oscillation

The effect of illuminating the test-piece by the stroboscope at a frequency differing from that of the vibrator by a fixed amount, say one cycle per second, is to make the test-piece appear to vibrate once every second. This slow-motion effect makes it possible to study its oscillation in detail. In subdued light the image is perfectly sharp and, in practice, a resonance search test is carried out in a few minutes by sweeping the oscillator control slowly over the range of frequencies likely to be encountered in service. A state of resonance of any part is distinctly seen as a sudden increase in the amplitude of its vibration, as presented in slow motion. The frequency at which this occurs can be read directly off the oscillator dial, with a calibrated accuracy of around two to three per cent. Having detected the frequency of any resonance, or resonances, it is usually a fairly straightforward matter of mechanical design to modify the offending parts so that resonance is shifted outside the range of possible excitation.

Where higher powers of excitation are required than that provided by the standard oscillator and amplifier, the equipment may be readily combined with a more powerful vibrator set-up, while retaining the advantage of the slow-motion feature. An example is illustrated in Fig. 2, in which a prototype magnetron is undergoing vibration

Fig. 1.—The oscillator (left) drives the vibrator (front) and the stroboscope behind it to produce a slow-motion image of the radio valve

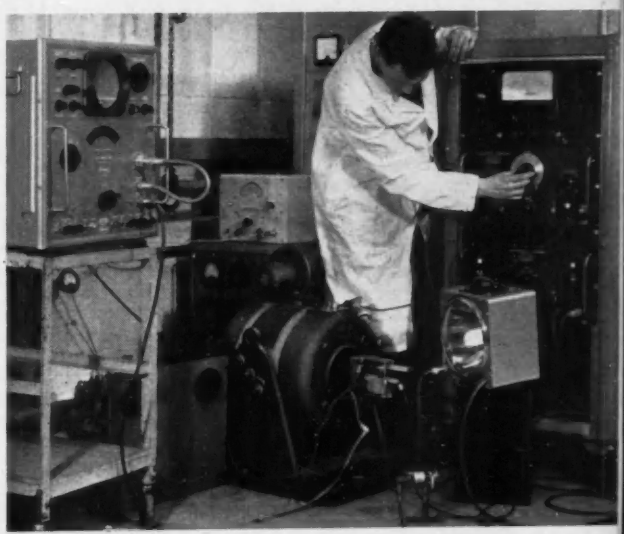


Fig. 2.—Resonance test on a magnetron. The effect on the emitted signal is displayed on the cathode-ray tube

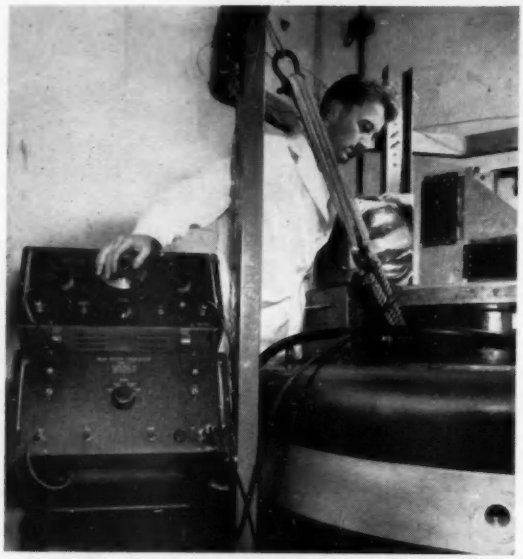


Fig. 3.—Guided missile components being vibrated on this large apparatus

testing at the laboratories of the Mullard Radio Valve Co. The control equipment and oscillator are mounted in a rack, which also houses a vibration meter calibrated in terms of acceleration and deriving its signal from a pick-up fitted to the magnetron mounting. The stroboscope is directly driven through the frequency-shifter, as before. As an additional indication of resonance, the magnetron is operating in the normal way while subject to the vibration. Its output is picked up by the waveguide in the foreground and fed to the oscilloscope at the left. This is set with the horizontal deflection indicating radiated frequency, so that it presents a simple bandwidth spectrum. A clearly-defined peak should appear under normal operating conditions on the face of the c.r. tube. Should mechanical resonance occur, the trace immediately broadens, flattens, and becomes unstable.

The scale of operation is taken one step further in Fig. 3, which depicts a test forming part of the development programme of the Bristol/Ferranti "Bloodhound" anti-aircraft guided missile. This large weapon is of the semi-active homing type, and carries powerful homing radar. Resonance of electronic components could easily result in a progressive feed-back effect whereby control-flutter would generate vibrating control signals which would in turn intensify the flutter, and so lead to rapid destruction. The vibrator illustrated (part of which fills the right-hand half of Fig. 3) can exert a vibrating thrust of $\pm$10,000 lb. It is driven by a very powerful amplifier, and is operated in a sound-proofed room. Resonance search procedure is as before, but piezo-electric pick-ups are used to give a quantitative indication of the accelerations involved on a valve voltmeter.

CONTROLLED THERMONUCLEAR REACTIONS

AT an ordinary meeting of the Institution of Electrical Engineers which was held in London recently in conjunction with the British Nuclear Energy Conference, Mr. D. W. Fry (U.K.A.E.A.) gave a lecture in which he reviewed work towards nuclear energy from controlled thermonuclear reaction. He said that a major section of the second "Atoms for Peace" Conference at Geneva was devoted to discussing the fusion work going on in many countries. The amount of material presented was considerable, and it was not possible in his lecture to do more than give the barest details of two or three of the major projects and to say a little about the stage which they had reached.

Dealing with the present stage of the "pinch" programme, he said that in many of the experiments which had been carried out neutrons had been observed to be emitted. While the conditions for producing the neutrons varied from experiment to experiment, no one had yet claimed that they had arisen from nuclear reactions in a plasma in which the particles were in thermal equilibrium. Observations of both fast and slow pinched systems had shown that a large unaccountable energy loss was also present. The cause was still being investigated. There was some evidence that large numbers of electrons might be gaining an excessive amount of energy and escaping across the magnetic field ions. Much more was needed to be known about the loss mechanism before they could be certain of it and were able to say whether it could be avoided by a suitable choice of operating conditions. A different approach to obtain a hot gas and release energy was the "Stellarator," which relied on a strong externally applied magnetic field to provide containment of the gas.

A third approach to trying to contain hot plasmas was the mirror approach, an open line system, the concept being a magnetic field in which the lines had a pattern produced by coils at the mirrors, often with a solenoid between the coils. What was sought to be done was to trap the plasma in the field and compress it and give it energy and try to raise it to the required temperatures. Many other systems were described at Geneva, including "Scylla" and the homopolar device.

The ingenuity shown in all the systems he had mentioned and others had been considerable. The experimental results obtained indicated that the behaviour of fully ionised plasmas was much more complex than could be accounted for by existing theories. With so many gaps in their knowledge, it was too early to say that any particular approach was likely to provide the best road towards the goal that they wished to reach. A great deal more work still remained to be done, and that research was not confined to the field of physics. Many engineering problems also required study, including the economic storage of energy, switching into and out of circuits in some cases in very short times and with reactive loads, the design of magnetic field systems to withstand the forces associated with establishing the high field required, and the problems of circuit detection.

Children's Christmas Lectures

Christmas lectures for children aged 13 to 17 years are to be given for the first time this year at the Science Museum. There will be two subjects, "From Man Power to Atomic Power," on 31st December and repeated on 1st and 2nd January; and "The Story of Flight," on 5th, 6th and 7th January. The lectures will commence at 2.30 p.m. and admission is free.

Electric Floor Heating Practice

2. Heat Flow in Solid Floors

By R. D. JACKSON*

This is the second in a series of five articles dealing comprehensively with the design of electric floor heating systems. In this instalment, the author sets out to discuss in some detail the mechanism of heat flow in solid floors

In multi-storey buildings the question of downward heat flow requires particular attention. When heat is produced within a solid, dissipation is by conduction in all directions, the quantity passing in any one direction being dependent on the thermal resistance of the heat path and the difference in temperature between the heat source and the space above or below in the case of an intermediate floor.

Floor heating installed in the intermediate floor of a multi-storey building will result in heat emission upwards from the floor surface and downwards from the surface of the ceiling below.

The proportions of the heat input passing in these two directions is calculated on the basis of the floor construction, and for practical day-to-day purposes a comparatively simple method is used. The problem is simplified where the rooms above and below are to be maintained at the same temperatures.

Fig. 7 shows a typical floor construction from which the following proportions are derived:—

Resistance above:

Surface resistance	0·5
$\frac{1}{8}$in thermoplastic tiles	0·035
$2\frac{1}{16}$in screed	0·165
Total	0·7 deg F/B.Th.U./hr/sq ft

Resistance below:

$\frac{5}{16}$in screed	0·025
6in hollow tile floor	1·5
$\frac{1}{4}$in plaster	0·21
Surface resistance	0·6
Total	2·335 "

Overall Resistance 3·035 "

Proportion of Heat Flow Upwards:

$$\frac{2{\cdot}335}{3{\cdot}035} = 77 \text{ per cent}$$

Proportion of Heat Flow Downwards:

$$\frac{0{\cdot}7}{3{\cdot}035} = 23 \text{ per cent}$$

This means that if a room on a top floor requires, say 26 B.Th.U./hr/sq ft to be emitted from the floor surface, the heat input requires to be greater, notwithstanding the fact that the room below is also heated. The required emission from the floor surface must be identified with the proportion of heat input which will flow upwards; thus continuing the foregoing example:—

26 B.Th.U./hr/sq ft = 77 per cent of heat input.

$$\therefore \text{Heat input} = \frac{26 \times 100}{77} = 33{\cdot}7 \text{ B.Th.U./hr/sq ft.}$$

If the room above is to be maintained at 65 deg F (62 mean taken) with a maximum floor surface temperature of 75 deg F, the average temperature at the level of the heating equipment can be calculated using the total resistance above the equipment modified to omit the floor surface resistance, thus:—

Total resistance as calculated	0·7
Surface resistance	0·5
Resistance of screed and finish	0·2
Heat flow	26 B.Th.U./hr/sq ft
∴ Temperature difference	$=26 \times 0{\cdot}2$
	$=5{\cdot}2$ deg F
∴ Average temperature at source	$=75+5{\cdot}2$
	$=80{\cdot}2$ deg F

The temperature on the underside of the floor can be calculated in the same way, thus:—

Average temperature at source	$=80{\cdot}2$ deg F
Resistance below equipment (minus surface resistance)	$=1{\cdot}735$
Heat flow	$=7{\cdot}7$ B.Th.U./hr/sq ft
∴ Temperature difference	$=7{\cdot}7 \times 1{\cdot}735$
	$=13{\cdot}4$ deg F
Surface temperature on underside	$=80{\cdot}2 - 13{\cdot}4$ deg F
	$=66{\cdot}8$ deg F

If a room below a heated floor is maintained at a lower temperature than the heated room the calculation for heat flow upwards and downwards must be modified. This is done by taking a temperature difference between the heat source and each space, and dividing the respective figures into the resistances to heat flow upwards and downwards. It will be appreciated that a big temperature difference reduces resistance more than a small temperature difference.

Thus if the upward and downward resistances are 0·7 and 2·335 respectively, and the heat source stands

* Technical Director, Tyrad Electric, Ltd.

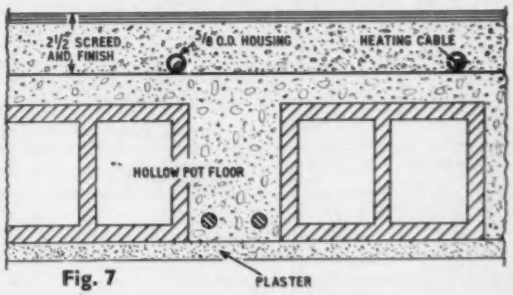


Fig. 7

at an average of 80 deg F with 65 deg F in the room above and, say, 55 deg F in the room below, these respective resistances would be reduced to:—

Upward resistance: $\frac{0.7}{15}=0.0466$

Downward resistance: $\frac{2.335}{25}=0.0934$

The *overall value* is now: 0.14

The *proportion of heat flow upwards* is: $\frac{0.0934}{14}$ =67 per cent

and the *proportion downwards:* $\frac{0.0466}{14}=33$ per cent

Taking again a top floor room requiring 26 B.Th.U./hr/sq ft from the floor it would be necessary to provide

$$\frac{26}{67}\times 100=38.8 \text{ B.Th.U./hr/sq ft}$$

This is an increase of 5.1 B.Th.U./hr/sq ft, approximately 15 per cent.

Supposing insulation comprising 2in wood wool slabs with a thermal resistance of 2 deg F per inch were applied to the underside of the floor in the latter example, heat flow would be affected in the following manner.

Resistance above $\frac{0.7}{15}=0.0466$

Resistance below (with insulation) $\frac{6.335}{25}=0.253$

Overall resistance =0.2996

$\therefore$ Proportion of heat flowing upwards $=\frac{0.253}{0.2996}$ =84 per cent

$\therefore$ Proportion of heat flowing downwards=16 per cent

Heat input required for a top floor room requiring a transmission rate of 26 B.Th.U./hr/sq ft $=\frac{26}{84}\times 100$ =31 B.Th.U./sq ft

The saving due to insulation is 7.8 B.Th.U./sq ft of floor area.

In a multi-storey building, the heat lost downwards from the first floor is gained from the underside of the second floor, which in turn gains heat from the underside of the third floor. The bottom floor in the building is therefore at an advantage, but it is not the usual practice to reduce the ground floor load in expectation of the heat coming from above.

Different floor constructions and finishes produce different results by the above method of calculation. If floor heating is installed in an overall thickness of 2½in of screed and floor finish where the floor finish consists of wood blocks of ⅞in thickness, and the structural floor is of 6in reinforced concrete with ⅝in plaster applied directly to the underside of the slab, the upward and downward resistances would be 1.48 deg F and 1.435 deg F respectively. The proportion of the heat flow upwards would be 49 per cent and the proportion downwards 51 per cent, provided the spaces above and below are maintained at the same temperatures.

Heat Loss/Floor Surface Temperatures

The total superstructure and ventilation loss of a given space represents the total amount of heat required to be emitted from the floor, and from this can be ascertained whether or not floor heating can be installed to operate within the generally accepted maximum of 75 deg F. It will be appreciated that approximately twice as much heat can be emitted from a floor to a room maintained at 55 deg F than in a room maintained at 65 deg F where the floor temperature is 75 deg F.

In many cases a room maintained at the lower temperature of 55 deg F has a lower total rate of heat loss for the same type of superstructure, and it would, therefore, be possible to operate a floor in such a room at a surface temperature appreciably below 75 deg F. Although in heat loss calculations a temperature rise of, say, 30 deg F may be applied for the purpose of maintaining 60 deg F against an outside temperature of 30 deg F, it is usual, for the purpose of determining the probable floor surface temperature, to estimate this against a figure representing both mean radiant and air temperature.

Heat is given off by the floor in two ways:—(1) By radiation, and (2) by convection, and sometimes, although it is not the general practice, the mean radiant temperature of the room is calculated.

Table I shows the method of calculation which is

TABLE I.—CALCULATION OF TEMPERATURE OF UNHEATED SURFACES

A	B	C	D	E	F	G					
Surface	"U" Value	T1–T2	Heat loss/hr per sq ft	Internal surface resistance	Surface temperature	Surface areas in sq ft		Product F & G		Mean temperature of unheated surfaces	
						Room A	Room B	Room A	Room B	Room A	Room B
Outside Wall	0.2	35	7 B.Th.U.	0.7°F/B.Th.U.	60.1	110	440	6611	26444		
Glass	1.0	35	35	0.7	40.5	140	210	5670	8505	84231	81459
Ceiling	0.2	35	7	0.6	60.8	500	500	30400		1400	1400
Partition Wall (to corridor)	0.4	10	4	0.7	62.2	250	50	15550	30400	60.16 °F	58.18 °F
Partition Wall	—	—	—	—	65.0	400	200	26000	3110 13000		
						1400	1400	84231	81459		

External design basis (T2) 30°F.
Internal air (T1) 65°F (conventional assumption).

TABLE II.—SURFACE TEMPERATURES RECORDED WITH ELECTRIC FLOOR HEATING

Situation	°F floor surface	°F inside face of external wall	°F desk	°F light fittings	°F partition walls	°F air temperature	°F external temperature
Room 1	73	63	72	69	70	67	38
Room 2	71	62	68	67	69	65	
Room 3	72	63	67	66	69	68	
Room 4	72	65	67	66	69	63	
Room 5	75	69	73	67	71	68	
Room 6	75	68	71	68	71	68	

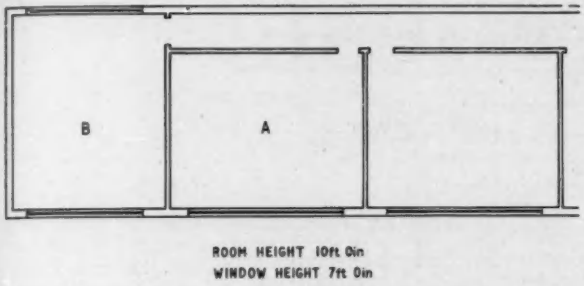


Fig. 8

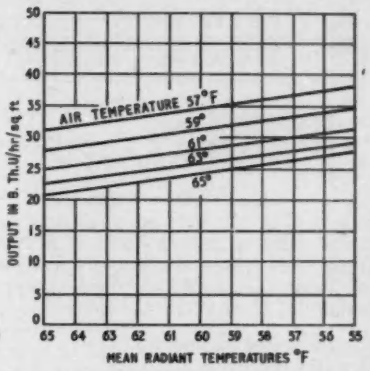


Fig. 9

based on conventional data. The inside surface temperature of the wall is determined by multiplying the hourly heat loss per square foot by the internal surface resistance. The result is the difference in temperature between the air and the surface and this figure should be subtracted from the air temperature.

By way of example:—

Internal surface resistance of wall = 0·7 deg F/B.Th.U./hr/sq ft
Hourly heat loss of wall = 10 B.Th.U./hr/sq ft
Temperature difference = 10 × 0·7 = 7 deg F
Internal wall surface temperature = 65 − 7 = 58 deg F

The positions of rooms A and B used in Table I are shown in Fig. 8, room A being an intermediate room with only one outside wall and room B being an end room. Room B has a lower mean radiant temperature and this illustrates that slightly higher rates of transmission can be expected in end rooms. Table II shows various surface temperatures actually recorded, and these are higher than arrived at using theory, although they are the result of that same theory. Air temperatures at the breathing line are normally 2 to 3 deg F lower than with comparable convection systems. For general purposes it is assumed that the mean radiant and air temperatures are approximately the same, and about 3 deg F lower than the specified comfort level where this is 60 to 65 deg F.

Emission of heat from a floor can vary within a room in so far as the difference in temperature, and thereby the emission, is greater near windows. For this reason loadings are often increased in the vicinity of large windows, and this arrangement also has the effect of reducing downdraught. Unfortunately, another effect of this practice is to accentuate edge losses.

The coefficient of transmission for floor heating is commonly taken as 2 B.Th.U./hr/sq ft/deg F, so that if this factor is divided into the total transmission required per square foot, the result is the difference by which the floor surface temperature must exceed the space temperature. A room nominally at 65 deg F would be rated at 62 deg F for this purpose, allowing a total emission of 26 B.Th.U./hr/sq ft. In a room maintained at 55 deg F, the actual space temperature would be taken as, say, 52 deg F, allowing a maximum emission of 46 B.Th.U./hr/sq ft for a maximum floor surface temperature of 75 deg F.

The output from a warmed floor, by radiation and convection, can be calculated using the appropriate formulæ. Outputs have been calculated against various air temperatures and mean radiant temperatures, and drawn as curves representing total outputs (Fig. 9). The quantity of heat which can be transmitted from the surface of a floor is dictated entirely by the difference in temperature between the floor and its environs. Thus it is possible to obtain transmissions of 5, 10, 15, 20, 50, or even 100 watts per square foot, provided there are the requisite temperature differentials, without exceeding 75 deg F on the floor surface.

Since the temperature differential is directly related to the quantity of heat transmitted from the floor surface, much higher rates of transmission can be obtained in rooms maintained at, say, 55 deg F than in rooms where the level is 65 deg F. A system operating with off-peak intake would, however, use up its stored heat more rapidly.

Floor Finishes

Most of the finishes in common use to-day have been used with electric floor heating, and those which have been found unsuitable are generally of the asphalt type. This is because such finishes have low softening points, some even pouring at about 80 deg F. The foregoing paragraphs have shown that floor finishes can affect heat flow in warmed spaces, particularly those above ground, but only in exceptional cases are allowances for downward loss increased for single-storey buildings. An exceptional case would be, for example, carpeting on felt. Floor finishing contractors are sometimes interested in the temperature on top of the screed on which their material is to be laid, and this can be calculated backwards from the floor surface standing at a maximum temperature of 75 deg F.

For example, if a ⅛in thermoplastic tile is involved, with a thermal resistance of 0·286 deg F per B.Th.U. per square foot per hour per inch thickness, together with a heat flow upwards through the floor and the finish of 30 B.Th.U./hr/sq ft, the difference in temperature from the top to underside of the tile is:—

$$30 \times \frac{0{\cdot}286}{8} = 1{\cdot}07 \text{ deg F}$$

The underside temperature of the tile would therefore be 76·07 deg F. If certain ¼in cork tiles were being used instead of thermoplastic tiles, with a thermal resistance of 2 deg F per inch, the temperature on the underside of the cork tiles would, by the same means of calculation, be 90 deg F.

Wood floors have a comparatively high thermal resistance, averaging about 1 deg F per inch. The screed temperature under a ⅞in wood block floor would be:—

0·875 × 30 = 26·25 deg F difference
screed temperature = 75 + 26·25 = 101·25 deg F

The floor construction and finish are alone responsible

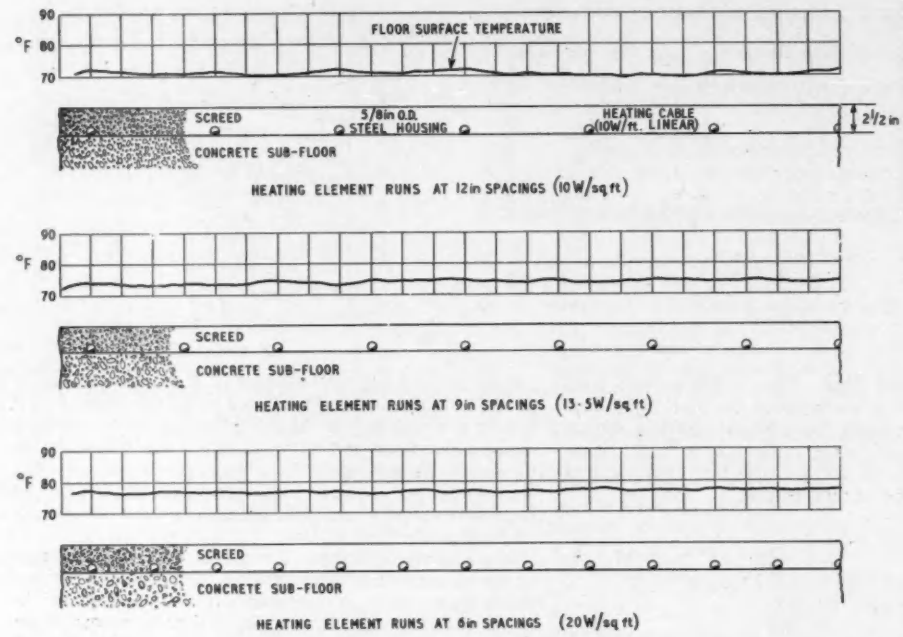


Fig. 10

for the diffusion of heat from its source in a warmed floor. The use of tubing of one kind or another, or any special diffusing mesh, has a negligible effect on the manner in which heat will flow, or its quantity.

Supposing heating elements were installed in steel, copper or aluminium tubes at the same depth in a floor. The only difference in resistance to heat flow would be due to the varying values of the materials concerned. For tubes of 19 gauge walls, these resistances would be as follows:—

Steel: 0·000127 deg F/B.Th.U./sq ft.
Copper: 0·0000152 deg F/B.Th.U./sq ft.
Aluminium: 0·0000283 deg F/B.Th.U./sq ft.

The thermal resistance of screed, finish and floor surface calculated in an earlier paragraph amounted to 0·7 deg F/B.Th.U./sq ft, which means that the overall resistances for comparison purposes are:—

Steel: 0·700127 deg F/B.Th.U./sq ft.
Copper: 0·7000152 deg F/B.Th.U./sq ft.
Aluminium: 0·7000283 deg F/B.Th.U./sq ft.

It is apparent that a variation in tube section could have little effect, and that if a mesh diffuser is used the cross-sectional area of the metal strands, being so small, would be capable of carrying so little heat at the low temperature involved that it would have no material effect on the diffusion of heat between heating runs or to the floor surface.

If a heating cable is directly embedded in the floor without tubing, the overall resistance is approximately the same since the thickness of screed and finish is normally reduced to 2in. In any case, with cyclic intake, any small differences would be lost after the first few days of the heating season, when the floor had absorbed heat to the optimum level.

Fig. 10 shows temperature gradients measured in the surface of a screeded floor. The heating element employed for the test was loaded to approximately 10 watts per linear foot and with runs made at 6in, 9in and 12in centres loadings at 20, 13½ and 10 watts per square foot were obtained. Diffusing material was not used.

Calder Hall Completed

ALL the reactors at the two Calder Hall nuclear power stations are now working. This stage was reached during last week when the fourth reactor on the site went critical. The operation was successful and this reactor will now undergo a series of tests while working up to full power in preparation for connecting into the grid system.

There are two atomic stations at Calder Hall, known as "A" and "B." Work on the first of these started in the summer of 1953 and on the second in 1955. Each station has two reactors and the first of the two in Calder "A" started operating in May, 1956. It achieved full power and was switched into the grid on 17th October, 1956, by Her Majesty the Queen. It thus became the first atomic power station in the world to produce electricity on a commercial scale.

The total capacity of the four turbo-alternators associated with the two reactors in the first station is 92 MW, of which about 70 MW is taken by the grid. So far just over 750 million kWh has been supplied.

The first reactor of Calder Hall "B" started operating in March this year and has been running successfully. Delivery of power was delayed by an accident to a turbo-generator in June, but will probably take place before the end of the year, followed in two or three months by the second reactor. The two stations will have a capacity of 184 MW and will supply 140 MW to the grid.

A similar station with four reactors is now nearing completion at Chapelcross, near Annan, in Dumfriesshire. One of the reactors here is already operating and the whole station will be complete by the end of next year.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

An Architect's Approach to Floor Warming

FOLLOWING recent correspondence upon the subject of Mr. Baden Hellard's article, it would appear that Mr. Barlow's letter published in your issue of 14th November has collected what can only be presumed to be partisan, rather than disinterested, criticism. May I place on record two pertinent facts which would appear to have been lost in the sound and fury of the correspondence?

(1) Comparative costs vary considerably with every type of installation, and far from embedded systems always being "half the cost" of a withdrawable installation, my company have had many instances where a contract has been secured on a direct cost basis against open competition with embedded systems. Incidentally, installed costs of a fully withdrawable system can be as low as £7 10s per kW in industrial buildings.

(2) No heating cable—embedded or withdrawable—remains static in the heating screed. Stresses through the varying coefficients of expansion of cable, sheathing and screed are the main determining factors of element life in the floor. Failure to make sufficient allowance for these factors may well create far more troubles than the vague worries set out by Mr. Hillier.

Surely the sane outlook on the whole matter is to accept the common view of the industry—that is, the right installation for each particular building, with plenty of scope for both systems.

London, S.W.1.

C. J. WHEELER,
Technical Sales Service,
Thermodare (Great Britain).

I DO hope that Mr. S. A. Williams' letter, published in your issue dated 12th December, will be most carefully studied by the "powers that be" concerned with the design of off-peak heating schemes and the preparation of suitable tariffs.

I have never understood why the electrical industry pays such scant attention to the possibility of low-temperature heating by means of hot-water pipes and radiators fed by an electric thermal storage plant. There are fashions in heating as in everything else, but I completely agree with Mr. Williams when he says that the electricity supply industry may do itself a great deal of harm by over-exaggerating the claims of electric floor warming.

Some six or seven years ago the American power companies, in their efforts to counteract a peak created by the summer air conditioning load, endeavoured to popularise electric floor heating. It was a complete failure. I was in Scandinavia early this year and discussed their own experience of electric floor heating with many heating experts and again I could find no one who was prepared to recommend it.

The problems of dealing with the peak are not peculiar to this country and we should take note of the experience of other countries, some of whom have far more experience of heating. As Mr. Williams has pointed out, central heating by means of other forms of electric heating can prove much more economical from the tenant's point of view and there is a need, in my view, for field tests so that the public can have access to figures which give a true comparison between one form of electric heating and another. It is also necessary for there to be fair comparisons between electric heating and forms of continuous heating provided by other fuels.

It has often been stated that it is quite useless to produce information on the costs of operation in one particular locality and in one particular installation, with another form of heating in another locality and in a quite different type of installation. Surely it should be possible to persuade a local authority to install floor heating in one block of flats and another form of electric central heating in a similar block of flats occupied by similar tenants and in a similar locality, and yet a third form of central heating in which the fuel is other than electricity.

It must be in the interests of everyone — local authorities, Electricity Boards, and tenants—to have true comparisons between one form of heating and another. Until we have these comparisons claims for one form of heating gainst another must inevitably be suspect.

London, W.1.

A. C. HAZEL,
Managing Director,
Hurseal, Ltd.

IT has been interesting to read the correspondence on withdrawable versus embedded floor heating systems, and I think the following up-to-date information might be of interest.

There is a system on the market giving all the advantages of the withdrawable system at little cost above that of an embedded system, and cases can be quoted where the installed cost has actually been lower. In 24 maisonnettes recently costed the price per kilowatt installed was £9, but generally speaking the figures fall between £10 and £15/kW. It should, of course, be kept in mind that this price can be most misleading; if the loadings per square foot are high it tends to reduce the price per kilowatt.

This system has been adopted by one city architect for one of the largest projects in the country, amounting to 3,000 flats. Mr. Hellard suggested in his article (*Electrical Review*, 31st October) that the cost of repairs to a fault on a withdrawable system would be in the region of £5 to £10, but it could be as low as 30s to 40s. Furthermore such a fault would affect only a small part of the floor area, the rest of which would remain operative.

Statements have been made that damage to the structure of a building would inevitably damage the withdrawable system, but here I would beg to differ. The system I have in mind can take up to ¼in shear and the cables would remain intact and could be withdrawn; this cannot be said of an embedded system.

Mr. E. W. Faithfull (*Electrical Review*, 21st November) appears to be apprehensive of the effect of a pneumatic drill upon a withdrawable system. Let me say that should a ductway be damaged the cable can be withdrawn and repaired at little cost. As the ductways are formed in the screed a rubber tube can be inserted and expanded and the damaged area filled with concrete and allowed to set, after which the tube can be withdrawn leaving a ductway as good as new and ready to receive the repaired cable.

As to the cost, I would estimate about £5 on the top side. It should be apparent from the above remarks that as there are no metal ductways and as the cables are made from glass suitably impregnated and containing a nichrome element there is little possibility of the corrosion feared by Mr. A. B. Hillier (*Electrical Review*, 21st November). So far as oxidisation of the elements is concerned, these are working at only a small percentage of their maximum rating and while the day may come when the element will have to be renewed, the cost is relatively small—a 250 kW installation can be completely re-elemented for under £100.

As for the vexed question of condensation referred to by Mr. Hillier, a test taken by the Ellis Laboratories shows that ducts formed in concrete by means of expandable rubber tubes under daily temperature variations of 80 to 95 deg F and relative humidity variations between 80 and 98 per cent contained no water after a three months' test. I feel that with such a system such small savings as can be shown with an embedded system do not warrant the risk taken.

Bramhope, nr. Leeds. W. T. SANDERSON, *Director*, H.V.E. (Electric), Ltd.

Tests on a Washer

THESE answers by housewives, writes Mr. J. A. Fraser in your issue of 28th November, about the "Merlin" sonic washer, are surely significant. So they may be, but they do not demonstrate that the appliance achieves the results claimed for it, as Mr. Fraser does not tell us what they are.

In a washing test on two pieces of material (soiled to his satisfaction rather than to a standard of the British Launderers' Research Association), only 51 per cent of the housewives judging the results gave the "Merlin" washed sample as cleaner than the soak-washed piece. It seems that the amount of dirt removed by the action of the sonic washer resulted only in a very small change in appearance of the piece concerned, so that the test was really of the housewives' ability to distinguish between two very similar samples. This is supported by the existence of both a large (25 per cent) "undecided" group and the 24 per cent who gave judgment for the soak-washed-only piece.

The staff of *Which?* whose comments on the sonic washer Mr. Fraser considers need amplification, seem to me to be quite undeserving of his magnanimous attitude. He has written little that justifies any inference that the appliance is effective as a washing machine.

I am not in any way connected with the sale or manufacture of washing machines.

London, W.2. B. M. TURK.

Hire-Purchase Terms

FROM his letter to you it appears that "Fair Play" does not read the Parliamentary reports. If he did he would have noticed that the Chancellor of the Exchequer is not worried about the possibility of the relaxation of hire-purchase restrictions producing "raging inflation."

There is one aspect of "Fair Play's" letter which one notices so often in these days and that is the complete disregard of the customer, who should come first. If buying terms can be made attractive, why should not the customer benefit? Let's have a little fair play for the customer.

Brighton. R. E. GAMLEN.

Britain's Largest Turbo-Generator

THE Central Electricity Generating Board has placed a contract for the largest turbo-generating unit yet projected in Britain. The unit, which is to be built by C. A. Parsons & Co., Ltd., will have a capacity of 550 MW. It will be installed at the Thorpe Marsh power station, near Doncaster, and is scheduled for commissioning in 1963. The value of the contract, which includes condensing and feed heating plant and main boiler feed pump, is well over £4 million.

The turbo-generator itself is a two-shaft machine operating two alternators, each of 275 MW. Steam will be fed into the machine at a pressure of 2,300 lb/sq in and a temperature of 1,050 deg F. The machine is a cross-compound unit, consisting of two lines arranged in line ahead, each line comprising four cylinders driving a 275 MW hydrogen and liquid cooled generator.

All eight cylinders are of the double-flow type. Steam enters the high-pressure cylinder on one line and is exhausted from it to the reheat section of the boiler where it regains its initial temperature of 1,050 deg F. The reheated steam is passed to the first intermediate pressure cylinder heading the other line and on leaving this turbine divides equally between duplicate intermediate pressure cylinders, one on each line. Final expansion of the steam is then through the two low-pressure cylinders on each line. The steam issuing from the eight exhausts enters four cylinders with a total cooling surface of 330,000 sq ft.

Voltage of generation is to be 18 kV at 3,000 r.p.m. The alternators will have direct-gas-cooled rotors operating with a hydrogen pressure of 45 lb/sq in and the stators are to be cooled with demineralised water which will circulate through the conductors.

Electricity Industry Borrowing Powers

THE Electricity (Borrowing Powers) Bill introduced in the House of Commons on Monday authorises an increase of £1,060 million in the borrowing powers of the Electricity Council and the two Scottish Electricity Boards. The reasons for the changes are explained in a White Paper (Cmd. 618).

In the period up to 31st March, 1965, it is proposed that the new limit for the borrowing powers of the Electricity Council should be £2,300 million (previously £1,400 million) and for the period up to 31st December, 1964, the new limit for the North of Scotland Hydro-Electric Board should be £300 million (£200 million) and for the South of Scotland Electricity Board £135 million (£75 million).

At 31st March, 1958, the Electricity Council had outstanding borrowings of £1,140 million and the balance of £260 million was fully hypothecated by outstanding commitments. The outstanding borrowings of the North of Scotland and South of Scotland Boards at 31st December, 1957, were respectively £164 million and £27 million.

In a booklet "Power for the Future," published by the Electricity Council in connection with the Bill, the industry's estimated capital requirements for the years 1958-59 to 1964-65, at current price levels, are given as £2,130 million. Power station construction accounts for £1,100 million, main transmission £270 million, nuclear fuel £100 million, and distribution £660 million. Of the total, £1,030 million, or 48 per cent, would be financed from internal resources. This represents some 20 per cent of the revenue from sales of electricity.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Mr. D. G. Brown,** O.B.E., M.I.Mech.E., of Gateshead, Co. Durham, as chairman of the North Eastern Electricity Consultative Council in succession to the late Mr. W. S. Hall, M.B.E., J.P. Mr. Brown is managing director of the Redheugh Iron & Steel Co., Ltd., Gateshead, and is chairman of the Tyneside Advisory Committee of the Northern Regional Board for Industry. He has been a member of the Consultative Council since 1952.

Mr. P. A. J. Manley has been appointed assistant superintendent, Large Turbine Department, Trafford Park, in the A.E.I. Turbine Generator Division. Mr. Manley received his technical education at the University College of South Wales and Monmouthshire, Cardiff, gaining the joint diploma in mechanical engineering. After two years of military service in the R.E.M.E. he joined the Metropolitan-Vickers Electrical Co., Ltd., in 1952 as a college apprentice and later joined the Mechanical Department; he has since been associated with the manufacture of large and medium steam turbines. He became chief production engineer, Mechanical Department, in 1955.

Mr. P. A. J. Manley

The B.B.C. has announced the appointment of **Mr. L. M. Robertson** as engineer-in-charge of its new Orkney television and v.h.f. sound broadcasting station.

During recent months the **South Wales Electricity Board** has been implementing its decision to introduce single-headed management into its eighteen Districts. The new managers of these Districts recently attended a management conference at St. Mellons when the photograph reproduced below was taken.

Mr. W. A. McNeill, B.Sc.Tech., M.I.E.E., M.Amer.I.E.E., has been appointed deputy managing director of Doulton Industrial Porcelains, Ltd., as from 1st January next, on which date he will relinquish his present position as chief engineer of Crompton Parkinson, Ltd. Mr. McNeill joined Cooke & Ferguson, Ltd., an associate company within the Crompton Parkinson group, as chief engineer in 1949. In 1956 he was appointed deputy chief engineer of Crompton Parkinson, Ltd., and deputy manager of the Development and Research Department. On the retirement of Mr. H. Astbury, M.I.E.E., in August last year Mr. McNeill succeeded him as chief engineer.

Mr. W. A. McNeill

Mr. W. Forbes Ritchie, until recently chief engineer of the Consolidated Pneumatic Tool Co., Ltd., at Fraserburgh, has been appointed manager of factory operations. This is a new position created as a result of the company's expanding manufacturing activities in all parts of the world. In recent years the company has augmented its output at Fraserburgh from a further large factory at Aberdeen, an extension of production in South Africa and the opening of a new manufacturing unit in India. This is in addition to existing plants on the Continent and in Australia. In his new position, Mr. Ritchie will be responsible for the overall supervision and co-ordination of manufacturing operations in all these centres.

Mr. S. C. Leslie has been appointed by Associated Electrical Industries, Ltd., as consultant on information policy, both external and internal. The appointment will take effect in February.

The ballroom suite at the Dorchester Hotel, London, was the venue on 9th and 10th December, when Mr. B. Baden, M.C., chairman of the **Matthew Hall** group of companies, together with his fellow directors, welcomed over one thousand guests to their annual cocktail parties and exhibition. The numerous facets of the group's activities were brought sharply into focus by a display of photographs, drawings and models showing some of the many contracts placed with the organisation.

Mr. R. W. Bridgland, A.M.I.E.E., the author of the article in this issue on "Simple Circuit Protection" (page 1143), received his technical education at Brighton Technical College and his professional training under the late Mr. J. K. Brydges, M.I.E.E. former borough electrical engineer of Eastbourne. During the war he served for six years with R.A.F. Bomber Command, Electrical Branch, and later with the Air Ministry, on electrical development and servicing. After the war he rejoined the Eastbourne Electricity Department and in 1951 he was appointed a second assistant engineer in the Operation and Maintenance

Mr. R. W. Bridgland

District managers of the South Wales Electricity Board at a management conference held at St. Mellons. Back row (left to right): Messrs. E. Broughton, J. Harley, L. Benallick, I. C. Williams, A. J. Leather and W. A. Coggins. Front row: Messrs. F. G. Copland, Wm. Davies, C. Evans, I. G. Evans, G. J. Hughes, A. C. Davies, G. V. Vaughan, R. Lefevre, T. E. Reece, B. Jones, H. B. Holloway and A. L. Barnett

Department of the East Sussex and South West Kent Sub-Area of the South Eastern Electricity Board. Mr. Bridgland has an interest in electronic engineering and for some time was engaged on development work of this nature with the British Thomson-Houston Co., Ltd., whilst with the Air Ministry.

Mr. D. T. Feek has been appointed engineer-in-charge of the new television and v.h.f. sound broadcasting station of the B.B.C. at Thrumster, near Wick. He joined the Corporation as a technical assistant in 1951 and has served in this capacity and later as an engineer at a number of television and sound transmitting stations. Since 1956 he has held the post of engineer at the television and v.h.f. sound broadcasting station at Blaen-plwyf in West Wales.

Mr. I. G. Craig, head of the contracts division and a member of the Cathcart executive board of G. & J. Weir, Ltd., has resigned.

Mr. F. L. Gibson, who joined Wolf Electric Tools, Ltd., eight years ago, has been appointed sales manager for the home market. He has been technical representative and, latterly, divisional executive, and has been closely associated with the portable electric tool industry for nearly twenty years.

Mr. F. L. Gibson

The Scientific Film Association announces the appointment of **Mr. E. J. Cooper** as general secretary.

Mr. P. E. C. Merryfield has resigned from the board of Veritys, Ltd.

Mr. D. F. Walton has been elected a director of Thos. W. Ward, Ltd. He has been in charge of the Railway Sidings Department for many years, becoming a local director in 1948, and has been in charge of this department since the retirement of Mr. J. Walton in 1955.

Miss Deanne Coltman (a receptionist in Liverpool), the winner of the Mazda Queen of Light Competition, being crowned by Mrs. Norma Danby (the 1957–58 winner) at the finals of the competition held at the Lyceum, London, on 9th December

At the annual dinner of the Newcastle-on-Tyne Branch of the **Electrical Contractors' Association,** Mr. G. N. Green, deputy chairman of the North Eastern Electricity Board, in proposing the toast to the Association, said that electrical contractors were key partners in the electricity supply industry, along with manufacturers and suppliers. He urged local authorities not to skimp electric wiring in new houses. He pointed out that the cost of a reasonable electricity supply was only a fraction of the total cost of a new house, and if wiring was not skimped, it would add a lot to the convenience and comfort of the tenant. Mr. C. R. Waterhouse (national vice-president), in replying, referred to the fact that the demand for electricity had doubled within a period of ten years. Electricity Boards and contractors should regard their activities as a true co-operative effort in the development of a great industry. Mr. B. A. Berrie (branch president) proposed the toast to the guests, to which Councillor R. S. Gray (Sheriff of Newcastle-on-Tyne) replied.

The **Gloucestershire Electric Club,** which was recently formed by men in the electrical manufacturing, wholesale and supply industries in Gloucester and Cheltenham, has held its first meeting in Cheltenham, when the following officers were elected: Chairman, Mr. A. E. Hicks (Beaven & Sons, Ltd., Gloucester); hon. secretary, Mr. T. P. Lovesey (British Insulated Callender's Cables, Ltd., Gloucester); hon. treasurer, Mr. E. K. Willis (Newey & Eyre, Ltd., Cheltenham). The members of the Committee are Messrs. P. C. Lewis (General Electric Co., Ltd., Gloucester), K. A. Waugh (Cardiff Electrical Repairs, Ltd., Gloucester), C. H. Wood (Midlands Electricity Board, Cheltenham) and I. P. Sommerville (British Engine & Boiler Insurance Co.).

Mr. B. Dawkins, B.Sc.(Eng.), A.M.I.E.E., has been appointed assistant manager of the Education Department for professional and technician apprentice recruitment and training of the Metropolitan - Vickers Electrical Co., Ltd. Mr. Dawkins received his technical education at Battersea Polytechnic, London University, graduating with honours in electrical engineering in 1945. After a short period with the Ministry of Aircraft Production, and some industrial experience in design and sales engineering, he went to Metropolitan-Vickers in 1948 as a college apprentice and later joined the staff of the Education Department, becoming a section leader and then chief assistant for professional recruitment and electrical training until his present appointment.

Mr. B. Dawkins

Seven more employees of **G. & J. Weir, Ltd.,** have completed fifty years' service with the company this year,

Preparing to cut the birthday cake at the "coming-of-age" cocktail party of Aberdare Cables, Ltd., reported in our last issue. Left to right: Sir John Pascoe (chairman), Mrs. Lamb, Mr. H. A. Lamb (director and general manager), Viscount Hall (director), and Mrs. F. G. Penny (widow of the late Mr. Penny, late chairman of Aberdare Cables)

"ELECTRICAL WHO'S WHO"

There are nearly 8,000 entries in the new edition of the "Electrical Who's Who," which covers people in all branches of the industry and profession. Copies can be obtained, at 27s 6d (plus 1s 6d postage), from Electrical Review Publications, Ltd., Dorset House, Stamford Street, London, S.E.1

and six of them recently received presentations from the directors by the chairman, Mr. J. K. Weir. The seventh, who is now with W. R. Skinner, Ltd., a subsidiary of the Weir group, received his presentation from Mr. J. R. Lang, managing director of Weir's, in London.

Mr. E. Lawrence, who has been with the Telephone Manufacturing Co., Ltd., for twenty years, including eleven years as sales manager to the Components Division, has now joined P. X. Fox, Ltd., precision potentiometer manufacturers, as sales manager and has opened a London office.

Mr. E. Lawrence

The United Kingdom Atomic Energy Authority has appointed **Mr. L. Grainger,** B.Sc., A.M.Inst.Met., as head of the Metallurgy Division in the Authority's Research Group at Harwell. He is to succeed **Dr. H. M. Finniston,** B.Sc., Ph.D., A.R.I.C., who is being released by agreement to take up appointment with the Nuclear Power Plant Co.

The General Electric Co., Ltd., announces that **Mr. G. A. Marriott** has been appointed managing director of the M.O. Valve Co., Ltd.

At the annual general meeting of the Junior Institution of Engineers, held on 28th November, **Mr. W. C. C. Ball** was elected chairman for the ensuing year.

Giffens, Ltd., electrical contractors, St. Albans, recently celebrated their golden jubilee with a dinner and dance. Three employees were presented with a gift of silverware for long service with the firm. The presentations were made by Mrs. R. A. Giffen, widow of the founder of the company.

OBITUARY

Mr. James Tweedale Schofield, northern area sales manager of the Ferguson Radio and Television Division of Thorn Electrical Industries, Ltd., died on 8th December following a road accident. Mr. Schofield, who was fifty-two, commenced his career with A. C. Cossor, Ltd., and joined Thorn Electrical Industries, Ltd., in 1949.

Mr. E. D. F. Burnett, Associate I.E.E., consumers' engineer in the Scunthorpe District of the Yorkshire Electricity Board since 1954, died suddenly on 10th December at the age of fifty-eight. He was previously engaged in the Commercial Departments of the Southern Electricity Board, the West Hants Electricity Co., Norwich Corporation and the Mid-Lincs. Electricity Supply Co., and earlier was assistant engineer with W. T. Glover & Co., Ltd., and Pirelli-General Cable Works, Ltd.

Mr. Thomas Wadsworth Hibbert, who was borough electrical engineer of Doncaster from 1928 until the nationalisation of the electricity supply industry, when he retired, has died at the home of his daughter at Solihull, Birmingham. He was for sixteen years with Barnsley Corporation before joining Doncaster Corporation in 1918.

Mr. R. L. Graham.—The death occurred on 10th December, at the age of fifty-eight, of Mr. R. Leslie Graham, manager of the outside contracts department of Hugh J. Scott & Co. (Belfast), Ltd., electrical manufacturers and contractors, with whom he had been for forty-two years.

Mr. Arnold Milner, director and secretary of the Spencer Wire Associated Companies, Ltd., Wakefield, died on 11th December. Mr. Milner joined the Spencer Wire Co., Ltd., in 1907, was appointed secretary in 1924 on the death of his father, Mr. J. Milner, and a few years later he was appointed financial director.

Mr. Robert C. Anderson, who was joint managing director of Beckett & Anderson, Ltd., mechanical and electrical engineers, Rutherglen, Lanarkshire, when he retired in 1949, died at Ayr on 8th December. Mr. Anderson, who with Mr. Frank Beckett founded the business in 1910, retired when the concern was acquired by the Coltness Iron Co., Ltd.

Mr. Eric Bertram Allam, A.M.I.E.E., governing director of E. P. Allam & Co., Ltd., died on 25th November.

WILLS

Mr. E. W. Bussey, C.B.E., a member of the British Electricity Authority from 1947 to 1952 and formerly general secretary of the Electrical Trades Union, who died on 16th July last, left £7,194 gross (£7,078 net).

Mr. F. G. Quance, A.M.I.E.E., formerly manager of the Accessories Department of the General Electric Co., Ltd., who died on 10th March last, left £21,274 gross (£21,080 net).

Lt.-Col. H. W. Watts, M.I.E.E., M.I.Mech.E., formerly borough electrical engineer of Epsom and Ewell, who died on 11th May last, left £1,698 gross (£163 net).

Mr. A. R. Bell, A.M.I.E.E., formerly general manager to the Uxbridge and District Electric Supply Co., and manager of the Windsor Electrical Installation Co., and the Slough and Datchet Electric Supply Co., who died on 5th July last, left £18,665 gross (£17,749 net).

Mr. R. V. Broberg, a director and a founder member of the Airedale Electrical and Manufacturing Co., Ltd., who died on 17th April last, left £3,203 gross (£2,180 net).

Mr. P. S. Heath, Associate I.E.E., managing director of W. G. Heath & Co., Ltd., who died on 30th August last, left £21,625 gross (£20,650 net).

Mr. F. T. Nurrish, joint managing director of George Bray & Co., Ltd., who died on 8th May last, left £16,131 gross (£14,140 net).

Mr. W. McDonald, managing director of the Hackbridge Cable Co., Ltd., who died on 6th May last, left £28,152 gross (£27,830 net).

Europe and the Commonwealth

Britain is sometimes presented as facing the dilemma of a choice between Europe and the Commonwealth. In fact, closer relations with Europe and a growing co-operation with the Commonwealth need not, particularly in economic affairs, involve a contradiction. It is widely acknowledged in Commonwealth countries that membership of a Free Trade Area is essential if Britain is to maintain her position in Europe and not fall behind in the race for economic expansion. It is also believed that the economic integration of Europe will lead to a more rapid growth in the demand for Commonwealth products. Nevertheless the gains and losses will be unevenly distributed and, since the Commonwealth's share of world trade is declining, there is also a natural suspicion in some countries of anything which might further weaken their position.

Informed discussion on the pattern of European and Commonwealth trade is, however, restricted by the lack of up-to-date authoritative publications on the subject and it is therefore good to learn that Britain in Europe, Ltd., have commissioned a detailed analysis of inter-Commonwealth trade and of the Commonwealth's trade with the Common Market. This should be ready in the third quarter of next year. In the meantime they have published a preliminary study ("Britain, the Commonwealth and European Free Trade," price 5s) which provides a brief but clearly presented introduction to such questions as the relative growth of Commonwealth and European trade and to the significance of such physical ties as Imperial Preference and the Sterling Area. The likely effect of the Common Market and Free Trade Area are also discussed.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £218 10s 0d
Fire Refined 99·70%	ton £217 0s 0d
Fire Refined 99·50%	ton £216 0s 0d
COPPER Tubes ..	lb 2s 1½d
Sheet	ton £247 10s 0d
H.C. wire and strip ..	ton £272 15s 0d
LEAD, English ..	ton £71 10s 0d
Foreign	ton £70 0s 0d
MERCURY	flask £74 0s 0d
TIN, block (English) ..	ton £759 10s 0d
ZINC, G.O.B. Foreign	ton £75 5s 0d
BRASS Tubes (solid drawn)	lb 1s 8¾d
Wire	lb 2s 6¾d
PHOSPHOR BRONZE Wire	lb 3s 11½d
PLATINUM	oz £19 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 24d—24½d

Financial Section

STOCKS and SHARES

ELECTRIC & Musical Industries have distributed the one-for-three scrip issue, which brings the issued ordinary capital to a little over £5 million. In the "x.c." form the 10s shares have been quoted lately at 46s 6d, which is equivalent to 62s before the adjustment. (The shares were quoted at 53s 6d only a month ago, and under 30s in the early part of this year). The new shares are transferable free of stamp duty and consequently stand a few pence higher. On the increased capital, the company has declared its intention of paying 20 per cent in dividends for the current year, given the maintenance of profits at about last year's level. This would represent an increase of 8¾ per cent on the payment for 1957–58, and it would still be heavily covered on the basis of the earnings for that period. A less austere dividend policy is proposed because the directors are satisfied that adequate financial provision has now been made for the heavy expenses of the reorganisation programme upon which the company has been engaged during recent years. At last week's meeting, Mr. Lockwood reported that group turnover had improved in the first four months of the current year, although he assessed the present situation in general with caution. The prospective yield on the shares is about 4¼ per cent.

Best Prices

With investment activity maintained at an unseasonably high rate, many industrial share prices have lately recorded new peaks for the year. Among leading electrical issues, the support for G.E.C. shares was a feature, and raised the price by 3s 9d to 40s. B.I.C.C. rose to over 50s, enhancing in the process the attractions of the company's share-exchange proposals to T.C. & M., of which the full details are awaited. Also in the cable group, Pyrotenax, Johnson & Phillips, and Aberdare improved. There was another sharp advance in British Tabulating Machine, which were quoted ex- the scrip issue at 55s 6d. Hoover resumed their upward course with a rise of 4s 6d, to 56s 6d, and Morphy-Richards were also good at 18s 9d. Gains of 3s or more in Ward & Goldstone and Reyrolle were among the best of numerous other improvements.

Company News

There was a sharp rise, from 6s 3d to 7s 3d, in the 5s shares of A. C. Cossor as a sequel to news of the plan for co-operation between the company and E.M.I. in developing electronic interests in Canada. Another transatlantic proposal, in the shape of the agreements in course of negotiation between Thorn Electrical Industries and the Philco Corporation of America, helped the former company's shares to rise to their best level of the year, the "A" being 24s 6d. Shares of Burco-Dean and Dewhurst & Partner both lost a part of previous gains after the announcement of the dividends and financial results, subsequent quotations

Price Changes in

Company or Board	Nom. Value	Middle price 15th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	76½		3	3	3 18 6	76½	72
Brit. Elec. 1974/77	100	73½		3	3	4 1 9	73½	68½
Brit. Elec. 1976/79	100	77		3½	3½	4 10 9	78½	72
Brit. Elec. 1974/79	100	87		4½	4½	4 17 9	87½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	17/6		6·8†	7†	8 0 0†	17/6	15/-
East African Power	£1	23/-		7½	8	6 19 3	23/-	17/6
Nigerian Elec.	£1	14/6		10	10	13 16 0	17/-	12/6
Perak Hydro-Elec.	£1	13/6		12½	10	14 16 3	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	15/9	+6d	17½	17½	5 11 0	15/9	9/9
Aerialite	1/-	8/3		51½	54	6 11 0	8/6	5/1
Allen, W. H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	27/3		8	9	6 12 0	29/3	19/9
Aron Elec. Ord.	£1	61/3		15	15	4 18 0	61/3	53/-
Assoc. Elec. Ord	£1	57/6		15	15	5 4 3	58/9	46/6
Automatic Tel. & El.	£1	75/-	+2/6	17	17	4 10 9	75/-	57/-
Babcock & Wilcox	£1	52/6	+1/9	15	13‡	4 19 0	54/6	41/9
Bakelite	10/-	21/3		15	15	7 1 3	23/-	17/6
Baldwin, H. J.	2/-	3/9	+9d	20	20	—	3/9	2/6
Berry's Electric	5/-	10/9x.d.	+1/-	10	10	4 13 0	10/9	5/9
Bowthorpe Holdings	2/-	11/-		37½	25*	4 11 0	11/-	6/6
British Aluminium	£1	72/6	+3/9	12	12	3 6 3	77/6	37/-
British Elec. Traction: Def. Ord. "A"	5/-	37/6		25	25	3 6 9	40/-	19/6
B.I. Callender's	£1	51/-	+2/-	12½	12½	4 18 0	52/-	38/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/3	19/-
British Tabulating	£1	55/6x.c.	+3/6	9	10	—	56/-	30/9
British Thermostat	5/-	36/3	+1/6	25	30	4 2 9	36/3	19/9
British Vac. Cleaner	5/-	4/3		10	10	5 17 9*	4/6	2/3
Brook Motors	10/-	43/9		25	24½*	5 10 9	43/9	27/9
Bulgin, A. F.	1/-	7/-		40	45	6 8 6	7/-	4/7
Bulpitts	5/-	10/9	+3d	—	12½‡	5 16 3	10/9	7/3
Burco Dean	5/-	12/-	−3d	22½	16*	6 13 3	12/3	7/9
Cable & Wireless: Ord.	5/-	12/6		10	10‡*	4 0 0	13/-	8/-
4% Loan	100	94x.d.		4	4	4 5 0	94½	89
Chloride El. Storage "A"	£1	66/3	+6d	17½	17½	5 5 9	66/3	55/6
Clarke Chapman	£1	63/-	−1/3	27½	27½	4 7 3*	72/6	55/-
Cole, E. K.	5/-	16/6	+3d	17½	17½	5 6 0	18/-	15/3
Cossor, A. C.	5/-	7/3	+1/-	2½	Nil	Nil	7/3	4/4
Crabtree	10/-	31/6		20	20	6 7 0	32/-	24/4
Crompton Parkinson	5/-	12/-x.d.	+9d	16	12*	5 0 0	13/6	8/3
De La Rue	10/-	33/3	+2/-	35	17½*	5 5 3	34/-	20/9
Decca "A"	4/-	33/9	+1/3	43¾	43¾	5 3 9	34/6	21/3
Desoutter	5/-	18/-	+1/-	32½	18¾*	5 4 3	18/-	13/6
Dewhurst	2/-	8/3	−1/-	20	20	4 17 0	9/3	6/9
Dictograph Tel.	2/-	7/-		20	20	5 14 3	7/3	4/7
Dubilier Condenser	1/-	3/6		30	20*	5 14 3	4/3	3/1
Duport	5/-	10/-		25	12½*	6 5 0	10/9	7/9
E.M.I.	10/-	46/6x.c.	+1/6	15	20*‡	4 6 0	50/-	20/9
Electrical Components	5/-	9/3		12½	12½	6 15 3	9/9	7/-
Elec. Construction	£1	28/9	+1/3	8½	8½	5 18 3	28/9	21/-
Elliott-Automation	5/-	17/3	−6d	—	10‡	2 18 0	19/9	11/6
Enfield Cable Ord.	£1	16/-	−6d	Nil	2½	3 2 6	18/9	13/9
English Electric	£1	60/-	+1/3	14	14	4 13 3	60/-	44/-
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	26/3		22†	12*‡	3 19 6	26/3	17/6
Ever Ready	5/-	22/3	+9d	37½	20*	4 10 0	22/3	13/9
Falk Stadelmann	£1	42/6		17½	15	7 1 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

being 12s and 8s 3d respectively. In each case profits for the year ended in September came out below the previous figures. The Burco distribution is being raised by the equivalent of 1 per cent to 16 per cent on increased capital, while the Dewhurst final dividend makes 20 per cent for the year, the same as before.

Plessey Prospects

The 10s shares of the Plessey Co. have moved up well, to 68s 9d, since the distribution of the full report for the year ended last June. In that period there was a decline of about 10 per cent in the group trading profit, but the dividend was maintained at a total of 30 per cent for the third year running, with ample cover, and the balance sheet displays great strength in reserves and liquid resources. In his review, Mr. A. G. Clark attributes the reduction in profits to the effect of national policies, rising production costs, and the company's very considerable development programme. Of the latter, the chairman reports that it is now bearing fruit; and from recent Government policy he sees expansion in the commercial outlook. There is a yield of a little under 4½ per cent on the shares.

Contactor Switchgear Meeting

The 5s shares of Contactor Switchgear, whose annual meeting was held last week, have advanced recently to about 12s, to yield approximately 5·8 per cent on the dividend of 14 per cent paid for the year ended last July. In that period records were established in output and in orders received, with the result that net profits improved by about 10 per cent to £85,000 (after tax). A moderate increase in the dividend distribution again left more than two-thirds of the surplus to be put back into the business. In the chairman's statement, a satisfactory start was said to have been made to the current year.

Brook Motors Dividends

A final dividend of 20 per cent declared recently by Brook Motors is the rate forecast by the directors at the time of the one-for-five scrip issue. It is payable on the larger capital and makes, with the interim dividend of 5 per cent paid previously, a total equivalent to 24½ per cent on the present capital of £865,000. This represents an increase of 3½ per cent on the 1956–57 dividend, and provides a yield of 5½ per cent on the 10s shares, which have appreciated substantially during the course of this year to their present price of 43s 9d. Following last year's very large expansion in earnings, the company's preliminary statement of the 1957–58 results reported a further improvement of some £24,000, to £404,000, in the net taxed profit.

S. Smith Outlook

The 4s shares of S. Smith & Sons (England) have been in renewed demand, up to 12s, since the annual meeting, when Mr. Ralph Gordon-Smith reviewed a year in which sales increased by 23 per cent and profits (before tax) by 19 per cent. Dividends were raised, in effect, to a total of 12½ per cent (of which 2½ per cent was in the form of an interim for the current year) and were covered nearly four times over by the distributable surplus. For the current year, the company is expecting a small increase in sales, but little change in the profits.

Electrical Investments

Company or Board	Nom. Value	Middle price 15th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	40/-	+3/9	12½	10	5 0 0	40/-	29/3
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	9/3		30	24	—	11/9	8/3
Greenwood & Batley	£1	57/6		17½	20	6 19 3	57/6	45/-
Hackbridge Holdings	5/-	15/3	+6d	20	20	6 11 3	15/3	7/6
Hackbridge & Hewittic	5/-	13/6		20	20	7 8 3	14/6	9/7
Head Wrightson	5/-	24/9	+9d	22½	17½*	3 10 9	26/-	16/9
Heatrae	2/-	7/6		15	20	5 6 9	7/6	4/-
Holophane	5/-	15/6		37½	22½*	7 5 3	15/6	12/6
Hoover	5/-	56/6	+4/6	50	50	4 8 6	56/6	31/-
I.C.I.	£1	36/9	+1/-	10	12	4 7 0*	36/9	23/9
Intl. Combustion	5/-	27/6		22½	25	4 11 0	28/3	19/3
Johnson & Phillips	£1	20/-	+1/3	10	5	5 0 0	25/-	15/-
Lancashire Dynamo	£1	43/9		11	11	5 0 6	43/9	28/6
Laurence Scott	5/-	16/3		15	15	4 12 3	16/9	12/6
Lister, R. A.	£1	33/-	+3/-	10	10	6 1 3	33/-	23/-
London Elec. Wire	£1	60/-		12½	12½	4 3 3	64/6	39/6
Lucas, J.	£1	43/6	+1/-	7½	10‡	4 12 0	45/-	27/9
Marconi Marine	£1	40/-	+1/3	10	10	5 0 0	40/-	29/-
Marryat & Scott	2/-	7/6		35	37½	5 0 0*	7/7	5/3
Mather & Platt	£1	49/3	−9d	15	15	4 1 3*	50/6	29/6
Metal Industries	£1	40/6x.d.	+9d	9	14	6 18 3	44/-	22/9
Midland Elec. Mfg.	£1	40/-	+1/3	12½	10*‡	5 0 0	38/9	26/6
Morphy-Richards	4/-	18/9	+1/3	20	20	4 5 3	19/-	14/6
Murex	£1	52/6	−6d	20	17½	6 13 3	59/3	48/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/-	2/3
Parsons, C. A.	£1	52/6		8½	7½*	2 17 3	55/-	43/-
Plessey	10/-	68/9	+2/6	30	30	4 7 3	72/6	55/-
Pye	5/-	14/9	−9d	12½	12½	4 4 9	17/-	10/-
Pyrotenax	5/-	34/9	+1/-	—	27½‡	3 19 3	34/9	27/6
Rayrolle	£1	91/3	+3/3	17½	17½	3 16 9	91/3	73/6
Rheostatic	4/-	7/6		12½	12½	6 13 3	8/-	6/-
Richardsons Westgarth	10/-	14/3		16½	8½*	5 17 0	15/9	13/-
Scottish Cables	4/-	11/9		27½	27½	5 8 9*	11/9	7/-
Simon-Carves	5/-	31/3		20	25	4 0 0	31/3	22/6
Smith (England), S.	4/-	12/-	+1/-	20	12½*†	4 3 3	12/3	7/-
Southern Areas	£1	12/-		7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	9/-		15	15	8 6 9	9/3	4/9
Sturtevant	5/-	17/6	+6d	15†	15†	7 10 0	19/6	14/9
Sun Elec.	£1	60/6		25	25	8 5 3	60/6	47/3
Switchgear & Cowans	5/-	8/9		25	22½	6 8 6*	8/9	4/6
Taylor Tunnicliff	5/-	17/9		15	17½	4 18 6	17/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	38/6	32/6
T.C. & M.	£1	36/-	+1/-	8½	8½‡	4 14 6	36/-	20/-
Telephone Mfg.	5/-	4/9	+6d	10	10	10 10 6	5/9	4/3
Telephone Rentals	5/-	14/3	+1/9	12½	12½	4 7 9	14/3	9/9
Thompson (John)	5/-	25/-		25	25	5 0 0	27/-	23/-
Thorn Elec. "A"	5/-	24/6	+9d	17½	17½	3 11 6	24/6	17/-
Thornycroft	£1	23/9		12½	7½	6 6 3	30/9	21/-
Tube Investments	£1	78/9	+1/3	15	17½	4 9 0	78/9	48/3
Vactric	5/-	27/6x.d.	+6d	25	25	4 11 0	—	—
Veritys	5/-	5/3		12½	2½	2 7 6	6/9	5/3
Walsall Conduits	4/-	18/3		20	22½	4 18 9	18/3	11/-
Ward & Goldstone	5/-	37/-	+3/-	40	25*	3 7 6	37/-	23/6
Watford	2/-	7/6		25	25	5 6 9*	7/6	4/-
Westinghouse	£1	42/6		18	10*	4 14 3	43/9	32/3
West, Allen	5/-	12/9	+3d	15	12½*	4 11 6‡	13/-	7/9
Wolf Electric	5/-	7/3		20	10*	6 18 0	9/-	6/9

REPORTS and DIVIDENDS

Contactor Switchgear, Ltd.—The annual meeting was held on 10th December, Mr. H. Rayner (chairman) presiding. In his statement, which had been previously circulated, Mr. Rayner said that the extensions of the Wolverhampton works were on the point of completion and it was hoped that the new buildings at Leominster would be ready for occupation in the early part of next year. The output during the year under review and the number of orders received had been a record. In addition to their general run of business they had received substantial orders for atomic power stations not only in this country but also for abroad. The trading results up to the present for the current financial year were satisfactory. There had been some falling off in the volume of business obtained, but it was felt that the relaxation of credit controls, coupled with the total amount of orders in hand, would ensure that they would work to full capacity.

S. Smith & Sons (England), Ltd.—In the course of his speech at the annual meeting held on 10th December, Mr. R. Gordon-Smith (chairman and managing director) said that sales during the year under review were 23 per cent higher than in the previous year. Reviewing Smiths organisation, he mentioned that they had designed and produced a wide range of electric and mechanical automatic clocks and time switches for electric and gas cookers, clothes and dish washing machines, dryers, heaters and similar apparatus. One aspect of this growing automatic control was the G.P.O.'s new automatic trunk dialling system. Smiths had developed a subscriber's charging meter which would enable subscribers to know, as they talked, how much their calls were costing them.

Dictograph Telephones, Ltd.—The annual meeting was held on 11th December, Mr. P. V. Summer (chairman) presiding. In the course of his circulated review of the year, the chairman said that the sales department at home made a considerable advance in the volume of sales during the year. Export trade had been variable. For some years past the best markets had been South Africa and Australia, but during the year there had been a marked falling off in orders from South Africa. Sales to Australia, however, increased.

Burco Dean, Ltd., reports group profits for the year to 30th September last of £404,981, as compared with £445,303 for the preceding year, to which is added investment income of £4,970. After providing £216,640 for taxation, the net profit is £193,311 (against £205,105). General reserve receives £125,000 and £5,000 is placed to the pension fund. It is proposed to pay a final dividend of 11 per cent, making 16 per cent for the year on capital increased by a one-for-two scrip issue. The total distribution for the previous year on the smaller capital was 22½ per cent. The balance carried forward is £100,234 (against £102,069 brought in).

Electric & Musical Industries, Ltd.—The directors announce that, in connection with the proposed increase of the authorised capital to £12,000,000 by the creation of £3,234,000 unclassified shares of £1 each, they have no present intention of issuing any of these new shares and they have no intention without the stockholders' consent of issuing such shares as will substantially alter the control of the company.

The Coventry Gauge & Tool Co., Ltd., reports a net profit for the year to 31st August last of £160,041, as compared with £134,364 for the preceding year. General reserve receives £100,000, and the dividend for the year is maintained at 6½ per cent, tax free, with a final payment of 4⅛ per cent. The balance carried forward is £208,985 (against £185,719 brought in).

E. V. Industrials, Ltd., is acquiring the whole of the issued share and loan capital of W. J. Furse & Co., Ltd., and W. J. Furse & Co. (Manchester), Ltd., for £699,500 in cash and 168,114 5 per cent cumulative preference £1 shares of E. V. Industrials. The consent of the Capital Issues Committee has been obtained to the preference issue. Arrangements have been made for the existing management to continue.

British Aluminium Co., Ltd.—The offer by the Tube Investments-Reynolds Metals Company to acquire the B.A. Company's shares has now reached the B.A. shareholders. They are offered one T.I. share and 78s cash for every two B.A. shares—equivalent to about 78s a share. The offer closes on 9th January or any later date (not after 9th February) which T.I.-Reynolds may determine. The board of British Aluminium does not recommend acceptance but wishes to proceed with the sale of 4,500,000 B.A. shares to the Aluminum Co. of America.

Dewhurst & Partner, Ltd.—The net profit for the year ended 30th September last is £133,978, after deducting £138,775 for taxation. This compares with a profit of £149,359 for 1956-57. The dividend for the year is maintained at 20 per cent with a final payment of 15 per cent.

The Pyrene Co., Ltd., proposes to create an additional 2,000,000 ordinary 5s shares and to issue 560,000 to existing shareholders by way of rights, in the proportion of one new share for every five held. The directors have no present intention of issuing any of the balance of the new shares. The proposals will be considered at an extraordinary meeting to be held on 30th December.

J. & E. Hall, Ltd., has concluded formalities for the purchase of the refrigeration and air-conditioning division of John Inglis & Co., Ltd., Canada.

Telephone Rentals, Ltd., has declared an interim ordinary dividend of 5 per cent (unchanged). It is proposed to make a one-for-five free scrip issue of new ordinary shares. The new shares will not rank for the interim dividend now announced.

New Companies

Portaway Earthing Equipment, Ltd.—Registered 18th November. Capital £100. Manufacturers of and dealers in earthing equipment and materials of all kinds, insulators, etc. Directors: F. Porter and Nellie Porter. Regd. office: 2, North Park Road, Harrogate.

Permaheat (Mossley), Ltd.—Registered 10th December. Capital £100. Manufacturers and marketers of electric blankets and bed warming devices of all kinds, and of electrically heated clothing, switchgear and controls therefor. Directors: W. Henson and W. A. Mascord. Regd. office: Union Mills, Mossley.

V. Laker & Co., Ltd.—Registered 12th November. Capital £1,000. Electrical engineers, etc. Directors: V. Laker, S. J. Harris and D. Fielder. Regd. office: 41, Leigh Road, Worthing.

Liquidations

Reliance Electrical Wire Co., Ltd., 228-231, Gresham House, Old Broad Street, London, E.C.2.—Members' voluntary winding-up. Liquidator, Mr. R. Pinto, 228-231, Gresham House, Old Broad Street, London, E.C.2, appointed 5th December.—Particulars of claims to the liquidator by 24th December. This is a formal notice. All creditors have been or will be paid in full.

Permaheat, Ltd., electrically heated pads and blankets, Spectator Street, Manchester, 4.—Winding up voluntarily. Liquidator, Mr. G. Slack, 337-9, Corn Exchange Buildings, Manchester, 4, appointed 28th October.

Allsopp & Booth, Ltd., distributors of residential and industrial electrical glassware, Brierley Hill Glass Works, Brierley Hill, Staffs.—Winding up voluntarily. Liquidator, Mr. G. W. Smith, 24, Lombard Street, West Bromwich, Staffs., appointed 27th November.

Potts & Son (Electrical Contractors), Ltd. (in voluntary liquidation).—Meeting of members on 14th January at 6, Commerce Street, Longton, Stoke-on-Trent, to receive an account of the winding-up by the liquidator, Mr. L. Goodwin.

Bankruptcies

G. W. May, 36h, Lewis Buildings, Chelsea, London, S.W.3, electrician, lately carrying on business at 2a, First Street, Chelsea, as an electrical contractor.—Receiving order made 27th November on debtor's own petition. Public examination 13th February at Bankruptcy Buildings, Carey Street, London, W.C.2.

J. Tate, formerly carrying on business at 13, Stainton Close, New Lodge Estate, Barnsley, Yorks., as a plumber and electrician.—Trustee, Mr. K. A. Miller, 55, Queen Street, Sheffield, 1, Official Receiver, released 2nd December.

W. H. Rosindale, Rigg Mill, Stainsacre, Whitby, Yorks., electrician, lately carrying on business as an electrical contractor at 12 and 14, Paragon Arcade, Paragon Street, Hull.—Last day for receiving proofs for dividend 24th December. Trustee, Mr. S. D. Moore, 4, Silver Street, Hull.

ELECTRIC KILNS

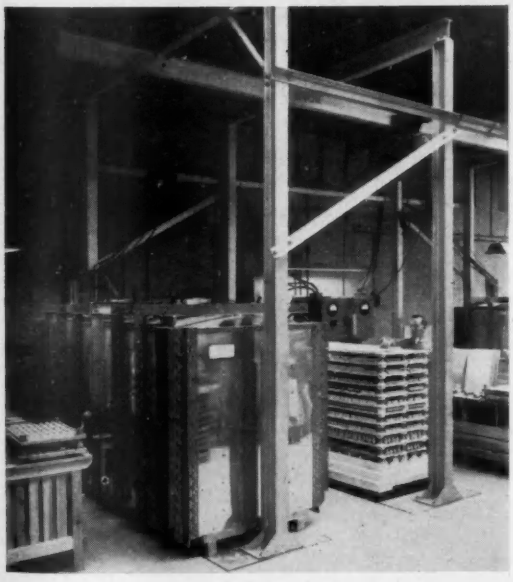
NEW DESIGN FOR THE FIRING OF ALL CERAMIC PRODUCTS

UNTIL recently most ceramic products were baked in coal-fired "bee-hive" or "bottle" kilns. These kilns have many disadvantages but it has only been during recent years that serious consideration has had to be given to other methods of firing. A simple but revolutionary design of an electrically-fired kiln has been developed and produced by Shelley Electric Furnaces, Ltd., of Stoke-on-Trent. These furnaces were originally made for the use of the parent company, Shelley Potteries, Ltd., but they have proved so successful that the subsidiary company was formed about two years ago and is now producing these kilns for other manufacturers both in this country and abroad.

Continuous Type

There are two general types of kilns in use, the continuous and the intermittent. The continuous kilns are in the form of a tunnel and the goods are carried through on a truck running on rails. Tunnel kilns can be fired either by gas, electricity or oil, but the capital cost is heavy. They also require a long, level space and the kiln has to be kept running day and night since the complete baking cycle is usually at least 24 hours. The firing cycle cannot be altered and the products are subject to considerable shaking and vibration during their journey through the tunnel. To keep the heat in the tunnel, fans are employed at each end and the turbulence of the air in the tunnel disturbs dust which settles on the products.

A top-hat kiln showing the integral lifting gantry. The second base is being loaded while the first base is being fired



Top-hat kiln used for firing large electrical insulators at the works of Bullers, Ltd.

Intermittent Type

In an intermittent kiln, a batch of products is fired and cooled, *in situ*, after the heating has been cut off. With this type of kiln a special heating cycle can be obtained. A coal kiln is an example of an intermittent type, but the whole process is extremely dirty. These kilns are usually circular in shape, bee-hive or bottle, but an improved walk-in type, fired by gas, is in use in some potteries.

Another intermittent kiln is the truck type. While one truck is being loaded with the products, another truck is being fired in the kiln. These kilns are usually rather small, up to 70 cu ft, and heat sealing is extremely difficult. As with the tunnel kiln, the products are subjected to vibration and shaking when the truck is pushed on the rails into the kiln. Truck kilns are usually heated by electricity.

Top-Hat Kiln

To overcome the disadvantages attaching to the kilns described above, Shelley Electric Furnaces, Ltd., designed a portable cover or "top-hat" kiln. The products are placed on a special base and an electrically heated cover is lowered over the top. Each kiln has two bases so that while one load is being fired, the other base can be loaded. Advantages of this top-hat kiln are that there is no movement of the products in or out of the kiln, there is a complete heat seal (on the diving bell principle) and cooling can be controlled by slightly lifting the cover so that there is an even cold air flow from the base. The thin walls of the kiln allow quick cooling and the whole unit, including the base, can be moved as required by factory layout. It has half the total running costs of the

The cover being moved from one base to the other

old coal kilns and requires no foundations or rails. The weight of the cover varies from two to five tons and an integral gantry and hoist can be supplied.

Since this type of kiln is electrically heated there are no fumes, the heating cycle can be controlled by a programme device, better working conditions are provided for the operators and, since there are no peak flame temperatures, better refractory material can be employed. If the products require a 12-hour heating cycle, the electricity can be supplied at off-peak rates during the night. The same cycle with a bee-hive coal kiln requires up to ten days: three days for preparation, three days for firing, three days for cooling and one day for emptying. Thus the top-hat kiln requires only half the labour force needed for a bee-hive.

Although the design of this kiln is very simple it can be seen from the above advantages that it represents a great advance in the firing of ceramics.

Manufacture of Ceramics

For the production of bone china tableware there are three baking processes. The firing of biscuit ware, which is the first part of the baking cycle, takes place at 1,270 deg C for 24 hours with a 24-hour cooling period. The temperature is critical to within ±10 deg C. After the initial firing, glaze is applied to the ware which is re-fired at 1,050 deg C for 12 hours with a 12-hour cooling period. Here the temperature is not so critical, but must be maintained within ±25 deg C. After decoration the bone china is fired at 750 deg C for eight hours with an eight-hour cooling period. The maximum temperature must be maintained within ±15 deg C.

For earthenware and sanitary ware the three firings are somewhat similar except that the initial firing must be at 1,100 to 1,180 deg C with a tolerance of ±20 deg C.

Large electrical porcelains are fired once only complete with glaze at 1,280 deg C for 42 hours with a 48-hour cooling period. The temperature for these products is extremely critical and must be maintained within ±5 deg C.

General Description of Kiln

The width of the rectangular cover of the top-hat kiln is important, but the height and length can be varied to suit the various applications. The width varies generally from 2 to 4ft, the lower figure being for a dense load of tableware and the higher figure for sanitary ware, etc. A kiln of about 70 cu ft is required for china, 200 cu ft for earthenware and up to 600 cu ft for large electrical insulators. A pair of 70 cu ft kilns costs about £4,000 complete with gantry, hoists and transformer.

The cover is formed of a steel-framed structure of channel sections covered with aluminium sheeting, lined with asbestos and a heat face insulation consisting of Morgan MR28 bricks. The total thickness of the cover is dependent on the firing cycle and varies from 5 to 7½in. A kiln designed for one type of product will, however, be suitable for another type but may not be quite so efficient. The wall bricks are held by 80/20 nickel chrome rods passing through their centres. The top of the cover is a refractory brick arch. The elements are of heavy gauge "Kanthal A1" wire with fused alumina supporting tubes. The elements are run in grooves in the brickwork and one element runs the whole length of a kiln. There are between 12 and 20 elements in each side of the kiln depending on the height. Elements are connected in parallel by strong clamps to heavy copper busbars and all wiring is carried out with mineral insulated cable. All elements in a kiln are physically similar and can be easily replaced.

The bases are built on a rigid steel chassis and heating elements are contained in the brickwork to prevent cold regions at the bottom of the load.

For kilns from 350 kW, the largest made so far, down to 80 kW, 415 V, three-phase supply is normally employed. Below the 80 kW rated kiln, a single-phase supply is desirable.

For high-temperature kilns, i.e. above 1,150 deg C, lower voltages are employed mainly because of the high conductivity of the refractory brick at high temperatures. Transformers with tappings and integral switchgear are used to supply a range of voltages of 80 to 125 V to allow for the ageing of the elements. Each oven is provided with a platinum-rhodium thermocouple for temperature control.

Temperature Control

Two types of control of kiln temperature have been employed using the thermocouple as the sensing device. The simpler form is purely a peak temperature on-off control which is suitable for the smaller ceramic items. For the bigger and thicker items, a programme controller is required to cover the whole cycle.

A Honeywell programme controller is used in conjunction with a contactor which switches the elements on and off in accordance with the pre-set cycle. This cycle is translated into the form of a cam which is rotated to the appropriate time cycle. The programme cam regulates the position of the pre-set pointer of the temperature indicating instrument and the difference between this pointer and the actual temperature indication, mechanically operates the on/off mercury limit switches.

To obtain a continuous form of control, as opposed to the on/off type, the company is developing a system employing a transductor to control the power to the kiln which will in turn be governed by another type of programme controller.

Simple Circuit Protection

Bridge-Connected Earth Leakage System

By R. W. BRIDGLAND, A.M.I.E.E.*

An improved system of protection without the use of fuses is described by the author. The system employs a bridge method and is only applicable where it is possible to centre tap the load such as soil heating, floor heating and some types of condenser installations built upon the unit principle

CIRCUIT protection by simple fuses has for long been sound for economic and fundamental reasons. However, instances arise when, for safety and other reasons, the simple fuse does not offer complete protection to a circuit. The primary function of a fuse is to isolate, in the shortest practicable time, any part of a circuit when conditions become abnormal. This usually implies that a short circuit, or earth fault, causes excessive

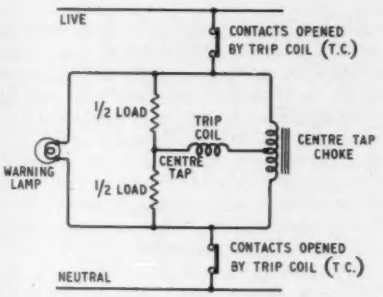


Fig. 1

current to flow and the fuse, if correctly graded, will melt to interrupt the supply.

An "open circuit" type of fault does not cause a current excess to flow, and the fuse maintains a circuit from the live conductor to one side of the break. Since there can be no voltage drop due to load current, this means that full supply voltage can appear across the open circuit and often constitutes a hazard, particularly where the break occurs at the neutral end of the load.

The following example is one illustration of how this hazard can arise. For horticultural purposes, increasing use is being made of a single 240 V insulated heating wire, of considerable length, buried in the ground. The neutral end of the load would normally be near earth potential. Due to the effect of the heat, the soil surrounding the wire may, after a time, possess very high resistance. The possibility of such a heating wire being cut by a spade cannot be ignored, and a live end remaining in contact with the spade can be dangerous to the operator. An open circuit can also be caused by corrosion of the conductor at a defect in the insulation and again if the circuit is protected by a simple fuse, dangerous voltage gradients can be set up in the soil.

Another abnormal condition which a fuse does not detect adequately is an earth fault which occurs near the neutral, or earthed end, of the load. In this case the increase in current due to the fault is often a very small proportion of the normal load current. This is particularly so in the case of the soil-heating installation, previously mentioned, which is most economical for loadings of 5 kW and more. Although the voltage gradients set up by such faults are small they can still be dangerous to animals, and the faulty section should be disconnected from the system as soon as possible.

To detect abnormal conditions in a circuit, which may range from a very small increase in load current to a complete open circuit, it is possible to compare the load conditions with a source of reference, and to use the difference between the two conditions to protect the circuit. A bridge-connected circuit offers the best way of achieving this, and although not in itself new, its use with modifications as a protective device is covered by a provisional patent.

The protective unit to be described was primarily developed for use with mains voltage soil-heating installations of high loadings, to give complete protection and safety of operation. At the same time its simplicity and cheapness add to the economic advantages of the heating scheme. It can also be applied to other forms of constant load as will be described, and because of the bridge form of connection can be designed to be unaffected by mains voltage fluctuations.

The original circuit is shown in Fig. 1 and the bridge reference arms in this case will be seen to be the centre-tapped choke from which a voltage of half that of the supply is taken. The only modification to the load is to provide a centre-tap connection, and in the case of the soil-heating application, since a given loading corresponds to a given length of wire, it is convenient for the manufacturer to mark this point during the winding on to the drum.

A standard earth leakage trip of suitable sensitivity was used as the circuit-breaker and is shown with its contacts

* South Eastern Electricity Board.

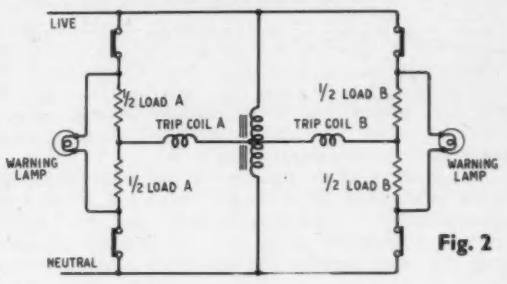


Fig. 2

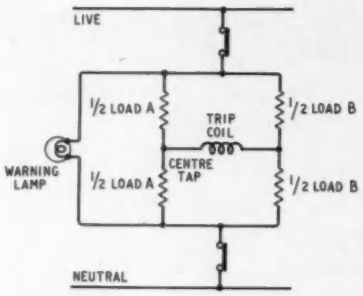


Fig. 3

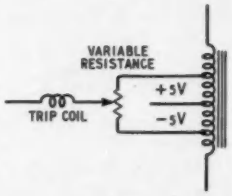


Fig. 4

connected in phase and neutral of the supply and with its coil connected between the centre tap of the load and the reference voltage. Under normal balanced conditions there is, of course, no voltage across the coil, but any disturbance of the bridge results in current flowing through it and causing disconnection of the load.

The same source of reference voltage can be used for several branches where independent tripping of the load is required, as shown in Fig. 2, where the circuit is applied to two branches. Alternatively, if there is no objection to the total load being disconnected, then the system can be cheapened by balancing one branch against the other to eliminate the centre-tapped choke (Fig. 3).

Adjustments to allow for different balancing of the load, or to allow for a bias effect to increase sensitivity, are easy to provide for, as shown in Fig. 4.

This simple circuit arrangement is ideal for the open circuit type of fault, but has disadvantages when small increases in current are considered. In common with most types of a.c. relays there is a certain amount of chattering at the threshold of operation which leads to erratic operation in this region. In addition, the limitation of sensitivity leaves a small section at each end of the load unprotected.

The circuit which was finally developed (Fig. 5) was the logical result of an attempt to overcome these difficulties.

Basically, it is the same as the simple arrangement, although the centre-tapped choke has been replaced by two indicator lamps in series. The step-up transformer is connected in place of the trip coil and there is, of course, no output from this transformer under balanced conditions of the bridge. When a fault does occur to unbalance the circuit, this transformer provides a voltage which feeds the grid of a cold cathode thyratron valve. This valve is connected in series with the coil of an earth leakage trip across part of the supply voltage. No chattering of the relay can take place, as the thyratron acts as an effective switch and until the required voltage, indicating a fault condition, is applied to the grid, it will not pass current to cause tripping.

The inclusion of the thyratron in the circuit gives high speed and reliable isolation of the circuit under all conditions, and the choice of a suitable transformer design allows the sensitivity of the circuit to be much improved over the simple arrangement previously described. The source of reference voltage is derived from the two indicator lamps in series which eliminates the need for a centre-tapped choke and causes tripping upon failure or removal of the lamps. The condensers are provided as a safeguard to maintain operation if both lamps are removed from the reference arms of the bridge. The load is normally energised when the indicator lamps are alight.

As a further refinement over the simple circuit a push-button to unbalance the circuit is incorporated, to prove operation at regular intervals, and to check the circuit components. It will also be noted that a connection from the earth leakage trip coil is brought out to a separate terminal (S). For the soil-heating application for which the protection unit was developed this enables a wire with an insulated screen to be used as a connection to each end of the load and by connecting the screen to terminal S the earth leakage trip will operate independently of the bridge connection.

This protection unit overcomes the difficulty of providing comprehensive unit protection for a constant load, connected to a single-phase supply with an earthed neutral. In its practical form the circuit has been built into a small robust unit which is both simple and cheap to produce. Providing that a centre-tapped connection to the load can be made, it is an economical form of protection with low installation costs.

The protection unit will no doubt find many applications other than soil heating, such as floor heating or the protection of condenser installations built upon the unit principle. Where series-parallel connection of condensers is practicable it is an easy matter to provide the necessary bridge connection to balance one section against another. This has obvious advantages in p.f. correction installations.

The question of operating voltage presents no problems as, with slight modification, the thyratron and tripping relay can be supplied from a voltage transformer and the thyratron grid transformer can be arranged as an isolating transformer or can be fed from a normal c.t.

The features incorporated in the protection unit are covered by Provisional Patent No. 32363 in the joint names of the South Eastern Electricity Board and Messrs. H. H. Lawrence and R. W. Bridgland. The author wishes to acknowledge the work in connection with the soil-heating application carried out by Mr. Lawrence, a paper by whom has already been published elsewhere. The author also wishes to thank "Seeboard" and the East Sussex and South West Kent Manager, Mr. N. Boydell, M.I.E.E., A.M.I.Mech.E., for permission to publish this information.

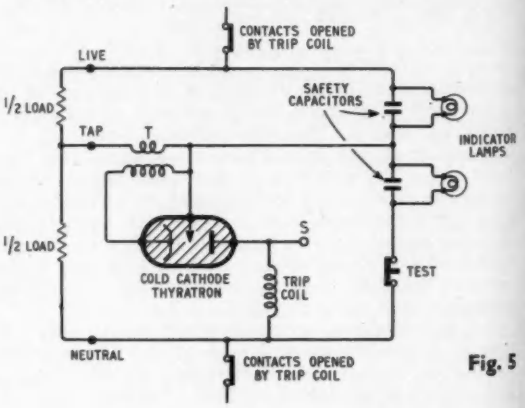


Fig. 5

VIEWS on the NEWS

By REFLECTOR

GREAT ingenuity is exercised by the Post Office in selecting names for new telephone exchanges. As a rule the names have some bearing on the district although this is not always obvious. A twin automatic exchange is being provided in Manchester and the first half is called "Guardian." Naturally the *Manchester Guardian* is pleased with this gratuitous piece of publicity although it fears that its joy may be shortlived because operators constantly have to explain to callers that they are not being put through to the newspaper. I may as well add that the second half is named "Pioneer" which is perhaps a reflection of the old aphorism "What Manchester thinks today....."

* * *

A few weeks ago I quoted a passage from a New Zealand journal and exposed my ignorance of antipodean terminology by guessing that a "pie-cart" was probably something like one of our ice-cream vans. A correspondent writing from the Royal Albert Dock (implying that he is a seafarer) tells me that a "pie-cart" is the Australian and New Zealand version of our coffee stall. As in London, these mobile caterers take up their positions nightly at strategic positions. The same note referred to "offal cookers for hydatids." My correspondent suggests that these are used in abattoirs in Australia and New Zealand for producing meat extracts, bone meal, etc.

* * *

According to the *Evening Standard*:—

> "The population of Horlington (Beds) has almost trebled in the past eight years. But still only the same amount of electricity is generated for their needs. Sunday dinners are cooked on Saturday. On Sunday food has to go on the stove for hours before it warms up."

Even worse than this, the villagers have to make a nightly choice—television or tea, for there isn't "enough electricity for the television and electric kettle to be on at the same time." Cannot the villagers switch their sets off for a few minutes? The Eastern Electricity Board, which is responsible for the supply, says that it is having difficulty in securing a site for the new substation which is needed to put things right and so it looks as though the village itself is to blame.

* * *

A friend has sent me a cutting from the *Birmingham Mail* of a letter from "Indignant" (a fairly regular contributor to the Press) regarding the repair of an electric iron. He begins by mentioning the warnings uttered by coroners from time to time against the tampering by "amateurs" with electrical appliances. Taking heed of these warnings he sent an electric iron which had gone wrong to an electrical shop for repair. It came back and immediately it was switched on the fuse blew—and it kept on doing so. He took the iron to an expert friend who discovered that the element had been screwed in contact with the casing. His friend rightly said that had the earthing not been in order there might have been a fatal result. Such happenings as this are no doubt rare but have a disproportionate effect in shaking the public faith in the electrical industry.

* * *

In the preceding note I have mentioned coroners' warnings. I have just read in the *News Chronicle* a report of the death of a man from asphyxiation through the choking of a geyser ventilating pipe by a bird's nest. At the inquest the coroner said:—

> "Why doesn't the Gas Board send exhibitions around warning people of this danger? Perhaps they are afraid people would stop using gas and go on to electricity. These things happen so frequently."

As the negligent use of both gas and electricity in bathrooms is hazardous there may be scope for co-operation of the two services in this respect, even if co-operation generally is undesired or undesirable.

* * *

Contact, the staff magazine of the Merseyside and North Wales Electricity Board, alleges that the following letter was received from a consumer by the Board's Northwich District office:—

> "Electricity Service. Will you kindly send your service man out, my Electric Blanket has gone again. It lights up, but no heat. Will pay bill next week."

* * *

Many inventions have been the result of accident rather than design. It seems that Thomas A. Edison, while an indefatigable designer, was also helped at times by fortunate chance. The appended extract from the *Electrical Review* of 15th December, 1878, illustrates this; it is a quotation of what Edison told the *New York World*:—

> "I don't know when I am going to stop making improvements in the electric light. I've just got another one that I found out by accident. I was experimenting with one of my burners when I dropped a screw-driver on to it. Instantly the light was almost doubled and continued to burn with increased power. I examined the burner and found it had been knocked out of shape. I restored it to its orginal form and the light decreased. Now I make all my burners in the form accidentally given to that one by the screw-driver."

* * *

I would like to extend the customary Christmas and New Year greetings to all my readers, especially those who have sent me helpful letters during the last twelve months.

Lightweight Diesel-Electric Locomotive

IN a paper presented on 11th December before the Supply Section of the Institution of Electrical Engineers Mr. C. M. Cock (English Electric Co.) described experience gained in 200,000 miles of fast passenger and freight service on British Railways of the 3,300 h.p. Deltic Co-Co diesel-electric locomotive, which weighs 106 tons inclusive of fuel, lubricating oil, and train-heating water. Salient features of this locomotive were given in the *Electrical Review* of 6th June. Its double cab is mounted on two 3-axle bogies, all axles being independently motored, and the maximum service speed is 105 m.p.h.

Power is provided by two 18-cylinder 1,500 r.p.m. 1,650 h.p. engines independently driving flange-mounted d.c. generators. Each engine consists in effect of three single-bank opposed-piston engines having three common crankshafts—an arrangement that provides end-to-end cylinder scavenging and eliminates valve-gear and cylinder-head sealing. Only one generator need be used for light-load running of the locomotive.

Six forced-ventilated six-pole traction motors, three to each bogie, axle hung and nose-suspended, are connected to the road wheels through 59:21 straight spur gearing. Field weakening in two stages down to 50 per cent for two engines and 30 per cent for one engine is obtained by shunting the field winding by resistors.

The ultimate limits imposed on locomotive weight, axle load, speed and rail adhesion are on account of the track. For heavy freight trains adhesive weight (which is less of a problem with diesel or electric traction than with steam) is of primary importance, but for high speed passenger trains the greatest power possible is required within the permissible axle load. The characteristic performance of a diesel locomotive is fixed by the engine power output. Lightweight diesels also reduce operating and maintenance costs. The locomotive described in the paper is said to be the most powerful single-unit diesel yet built and its weight-power ratio, 72 lb/h.p., the best yet achieved.

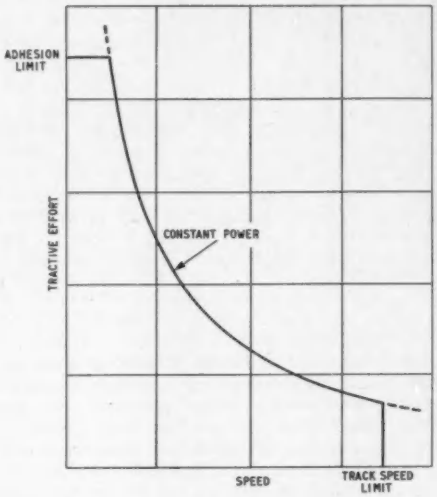
DISCUSSION

The discussion was opened by Mr. H. C. Johnson (British Railways) who said that, apart from inevitable teething troubles, by and large the basic equipment—engines, generators, and so on—were doing very well indeed. Most of the trouble experienced seemed to arise from the auxiliaries. The present mixture of steam, diesel and in some cases electric, traction was difficult and he looked forward to the day when he could get a fleet of diesel locomotives in an area with the necessary maintenance facilities.

Mr. E. S. Cox (British Transport Commission) said that one of the figures in the paper showed that at between 40 and 80 m.p.h. not less than 400 h.p. out of that delivered at the engine shaft was lost in the electric machines. That was nearly three times the power required to move the weight of the locomotive at 60 m.p.h. It was not to the detriment of the Deltic, for it was common experience with nearly all high-power locomotive transmissions.

Mr. H. H. C. Barton (Merz & McLellan) suggested that the incorporation of a scheme of changing the gear ratio, which the French had developed to some extent, would probably provide, for the first time, a general purpose mixed-traffic duty locomotive which could cope with anything in the future.

Mr. J. H. R. Nixon (Brush Electrical Engineering Co.) submitted that weight reduction presented a formidable challenge to the designer of electrical equipment for diesel locomotives. A good deal of expenditure on research with a view to reducing the weight would probably be worth while. Engines comparable in weight, speed and performance were available in conventional types, and hydraulic mechanical transmissions of comparable power were made in this country, although under



Typical performance of a diesel locomotive

licence, from foreign design. The author's company was therefore to be congratulated on an outstanding technical achievement which was all-British.

Mr. G. R. Higgs (Metropolitan-Vickers Electrical Co.) pleaded that wherever possible tractive effort and horsepower should be discussed not in relation to drawbar but in relation to the rail. That provided a much simpler and more accurate method of calculation.

Mr. W. Collis suggested that the connection of all six motors in parallel would have enabled smaller contactors, reversers and motor cables to be used, and might have eliminated equalisers and sanding equipment.

Mr. W. G. Jowett (English Electric Co.) pointed out that each engine generator was fitted with automatic load control designed to give a pre-set output at any engine speed. It would, therefore, be difficult to operate both sets in parallel, particularly as regards stability. To operate the generators in series would be preferable.

Mr. F. C. E. Smith said that most diesel locomotives with a high power to weight ratio employed hydraulic transmission, and the construction of the Deltic locomotive was therefore particularly important. It showed that locomotive power to weight ratio was dependent more on the type of diesel engine and on the design of mechanical parts than on the type of transmission.

Mr. F. G. Clements expressed the hope that something would be done to reduce the noise and vibration of diesel engines. The driver was made to feel comfortable in the cab of the Deltic, but that advantage was lost if he had to exert a large force to operate some form of dead man's device.

INDUSTRIAL NEWS

Power Manipulator for Windscale

The Atomic Energy Division of the General Electric Co., Ltd., has received an order for a power-operated manipulator from the Industrial Group of the United Kingdom Atomic Energy Authority. This manipulator will form part of the expanding "hot laboratory" facilities at the Authority's Windscale establishment, where its primary use will be in the inspection of irradiated fuel elements including, eventually, those from the commercial power stations at present under construction.

The manipulator is capable of lifting and positioning loads weighing as much as 750 lb, but it can also be used for delicate handling operations. It is completely controlled by one person from a small movable console fitted with two "joysticks." During recent months, a manipulator of the type on order aroused considerable interest when it was demonstrated both at the German Industries Fair in Hanover and at the Atoms for Peace Exhibition held in Geneva.

Trade Mission to Ghana

The President of the Board of Trade announced in the House of Commons on 10th December that the Government has accepted an invitation from the Ghana Government to send a trade and industrial mission to Ghana. The purpose of the mission will be to reaffirm the United Kingdom's interest in expanding trade with Ghana and to suggest ways in which British enterprise might assist development in Ghana. Sir George Binney has accepted the President's invitation to lead the mission. The names of the other members will be announced later.

Radio Show, 1959

The Radio Industry Council announces that next year's National Radio and Television Exhibition will be held at Earls Court, London, from 26th August to 5th September, with a preview on 25th August.

Permali Film

A film, "Permali Progress," showing how several manufactures in the Permali group of companies have been concentrated into one large modern factory at Gloucester has been produced by the "Big Six Film Unit" for Permali, Ltd., Bristol Road, Gloucester. The latest techniques and equipment employed for producing densified wood laminates—"Permali," "Hydulignum" and "Jabroc"—and also the manufacture of "Dialam" resin-bonded paper and fabric bushings for voltages up to 88 kV are included, and the production of newer materials—"Permaglass" glass-fibre reinforced laminates, "Permaflon" processed p.t.f.e. and "Permacast" cast resin insulation—are also described. A detailed description of the new factory, which is situated on a 7 acre site opposite the original Gloucester works, is given, and the ancillary services provided by the drawing office, laboratory and finishing departments are also shown.

Benjamin Illuminated Addresses

In connection with their golden jubilee celebrations, the Benjamin Electric, Ltd., have presented illuminated addresses to the Benjamin Electric Manufacturing Co., of Des Plaines, Illinois, U.S.A., and the Amalgamated Electric Corporation, Ltd., Toronto, Canada. These addresses have been skilfully executed in rich colours. A heavy golden seal is appended by the signatures of the chairman (Mr. A. E. Iliffe) and the managing director (Mr. H. G. Campbell). The addresses are mounted in hide-bound cases lined with rich maroon velvet, and finished with golden clasps.

Exporting to South Africa

Useful background information for exporters to South Africa is contained in "The South African Market," an illustrated booklet of some fifty pages published by Barclays Bank D.C.O. After brief notes on the geography, climate and structure and habits of the population, the market for consumer and capital goods is described with reference to the growth of local industry and its effect on the country's need to import. Details are also given of the Government's participation in industry and of import controls and tariffs; there is a section on South-West Africa; and it is stated that Barclays Bank D.C.O. will provide manufacturers with the names of importers and introduce them to suitable agents and representatives.

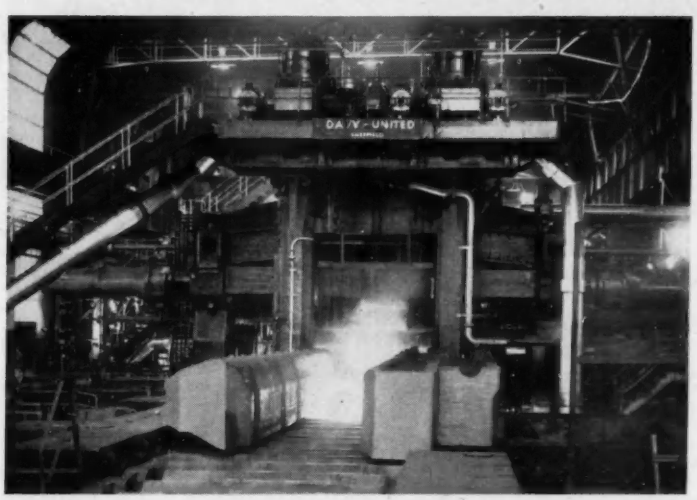
In the long run it is thought that South Africa will tend to import fewer consumer goods and more capital goods. At £180 million, imports from the United Kingdom in 1957 were nearly a third of the Union's total imports, and the U.K. supplied over 45 per cent of the £249·9 million worth of "metals, metal manufactures, machinery and vehicles" imported. The value of electrical goods imported from the U.K. in 1957 was £18 million. The next largest suppliers were the United States and Germany.

Replacing a Slabbing Mill

The start of production rolling on the new universal slabbing mill at the Abbey Works of the Steel Company of Wales marks the successful conclusion of over three years of planning by the company's engineers. Faced with the task of increasing slab rolling capacity from 48,000 to 60,000 tons per week, to meet requirements when a £50 million development scheme, at present under construction, is completed, it was decided that the additional tonnage called for the installation of a universal mill.

As all the steel ingots produced in the works have to pass through one slabbing mill, it was inevitable that the decision to remove the existing mill and install a new one would cause interference with production, which would affect the whole works. It was

The new universal slabbing mill at the Abbey Works of the Steel Company of Wales



therefore vital to plan a changeover which could be completed in the shortest possible time.

Because of the lack of headroom in the existing mill building a conventional universal mill could not be considered, so the company's engineers collaborated with the Davy & United Engineering Co., Ltd., to obtain a design for a mill suiting their requirements. The main difference between the new mill and other universal mills is that the drive to the vertical rolls is through a gear-box, mounted above the mill, the final drive to the rolls being by 10ft long vertical spindles.

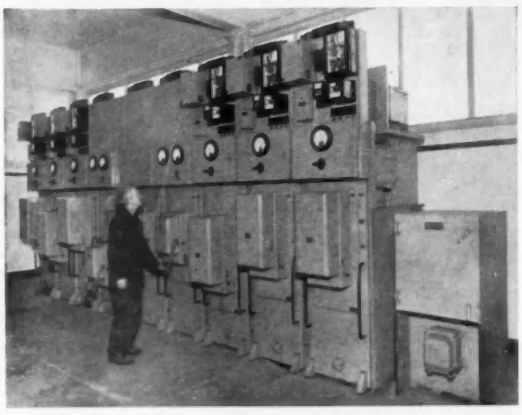
Dismantling of the old mill commenced on 17th November and was completed within 48 hours, some 1,374 tons of equipment having been removed.

Erection of the new universal mill commenced on 20th November and 2,375 tons of equipment ranging in weight up to 142 tons was installed. Much of the electrical installation had already been completed last April when the mill was stopped for four days to allow the installation of the 4,000 h.p. d.c. motor required to drive the vertical rolls. Final electrical work was able to commence on the eleventh day of the changeover and as soon as this was completed the mill was turned over without load and commissioning tests began.

While it was inevitable that the changeover caused some disruption to production this was reduced by the advance purchase of 58,000 tons of slabs from other steelmakers. These, together with operating stocks, enabled the hot strip mill to continue production.

Carbonisation Plant

During development of the Manvers Main coking and by-products plant under a £9 million programme, Crompton Parkinson, Ltd., supplied a large quantity of switchgear and transformers. Since coking plant operations are continuous, it is essential to ensure an uninterrupted electrical supply. The distribution is therefore arranged in the form of duplicate feeders with alternative sources of supply. The power house contains two 5·5 MVA, 3·3 kV generators and an alternative supply is available from the Yorkshire Electricity Board via an 11/3·3 kV, 6,000 kVA transformer.



Crompton Parkinson nine-panel, 3·3 kV 150 MVA switchboard installed in the booster house of Manvers Main coking and by-products plant

Industrial Canteens

H.M. Stationery Office has published (at 2s 6d) a booklet prepared by the Ministry of Labour and National Service and the Central Office of Information on "Canteens and Messrooms for Small Factories." It covers the requirements for dealing with staffs of up to 100 and first sets out the factors which have to be taken into account when setting up a canteen. Next the planning is considered, such points as ventilation, lighting and heating being covered. The layout and equipment of kitchens and ancillary services is illustrated and described.

It is said that in a factory using steam all the year round steam is most economical and efficient for cooking purposes; gas and electricity are equally efficient. We notice, however, that the only cooking equipment illustrated appears to be gas operated.

A great deal of other information is included in the booklet and there are even sample menus.

Import Duty on Instruments and Apparatus

In reply to a question in the House of Commons on 9th December the President of the Board of Trade said that he was proposing to widen the scope of the arrangements for remitting duty on instruments and apparatus. The Board of Trade would be prepared to consider applications in respect of all instruments and apparatus imported on or after 1st January next, which are covered by the definition in the Import Duties Act, 1958 (paragraph 1(c) of the Fourth Schedule), where the rate of duty is 25 per cent or more and the amount of duty chargeable is £50 or more. The imposition of a minimum value limit had been necessary in order to make this concession possible without adding disproportionately to Civil Service staffs. The following are the details of the arrangements to which the President referred:—Duty may be remitted on the following instruments and apparatus and parts thereof imported on or after 1st January if similar articles are not for the time being procurable in the United Kingdom:—Optical and scientific instruments and apparatus; measuring and checking instruments and apparatus; apparatus based on the use of X-rays or of the radiations from radioactive substances; thermionic, cold-cathode and photo-cathode valves and tubes; and discharge lamps.

Applications in the case of goods for importation on or after 1st January, 1959, which are ordered on or after 10th December, will be accepted only in respect of goods on which the full rate of duty is 25 per cent or more, and the amount of duty chargeable at the full rate is £50 or more in the case of complete instruments and apparatus and production parts (i.e. parts for incorporation in instruments or apparatus manufactured in the United Kingdom) and £5 or more in the case of replacement parts. These restrictions will not apply to goods for importation on or after 1st January next if they were ordered earlier than 10th December, so long as application in respect of them is made to the Board of Trade on or before 31st December. They will, however, apply to all applications posted later than 31st December unless there are exceptional reasons why application was not made before this date. Inquiries should be addressed to the Board of Trade, I.M.1, Duty Remission Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: Chancery 4411), from whom notes for the guidance of applicants under these arrangements (D.F.N.1(c)) can be obtained.

New Customs Tariff Published

The new Customs and Excise Tariff, based on the internationally agreed classification known as the Brussels Nomenclature, has now been published (price 12s 6d) and will come into operation on 1st January, 1959. The Board of Trade state that importers and import agents should obtain copies of the new tariff in order that they may enter goods in the correct manner; otherwise they may experience difficulty in clearing their goods through the ports. The tariff is in a blue binding to distinguish it from the advance yellow-bound edition issued last June. This should now be discarded as the new edition incorporates many amendments and additions.

Metal Price Tables

We have received from Oliver Brothers, Inc., 417-421, Canal Street, New York, 13, N.Y., the latest edition of their useful tables of iron, steel, wire and non-ferrous metals and of "manufactured hardware" which brings prices up to 30th September last; they go back to December, 1913.

Revo Mobile Showroom

The Revo Electric Co., Ltd., has recently completed a new mobile exhibition showroom. It consists of

The interior of the new Revo mobile showroom showing the switchgear which was awarded a gold medal at Brussels ; on the right is a section of the lighting display

a towing unit and an articulated trailer and is arranged in such a way that exhibits can quickly be changed from industrial equipment to a range of home appliances. It carries its own power unit for complete heating and illumination. The showroom will tour the country with the company's sales staff, so that customers can see at first hand a collection of its latest range of products. It has recently been exhibiting a selection of industrial lighting equipment and switchgear in the Coventry area.

Computer for W. & T. Avery

Panellit, Ltd., Willesden, a member of the Elliott-Automation group, has supplied a three-cabinet analogue computer to W. & T. Avery, Ltd., Birmingham, for use in solving problems in hydraulics. The machine has a total capacity of nearly 50 amplifiers and includes a number of non-linear units such as servo multipliers, new silicon diode arbitrary function generators and others.

Semi-Conductor Bibliography

The second bibliography, published by the Newmarket Transistor Co., Ltd., contains over 2,500 references to published works on semi-conducting materials and transistors. The four main sections—semi-conductor theory and measurement, semi-conductor processing, rectifiers and diodes, and transistors, are each further subdivided to assist reference. Copies are available from the company at Exning Road, Newmarket.

Diesel-Electric Plant Handbook

A reference book—"Diesel Plant Operators' Handbook"—intended to give the operator of diesel-electric generating equipment the essential facts about the equipment in his charge in a simple and concise form has been published on behalf of Blackstone & Co., Ltd., by Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2, price 20s. The basic principles of electricity, magnetism and a.c. and d.c. generation are given in the opening chapters with details of instruments and voltage regulators, followed by chapters on power plant operation and maintenance. An introduction is then given to the diesel engine, with a review of cooling and lubrication systems, methods of fuel injection, turbo-charging, etc., and operation and maintenance are discussed. Lubrication and fuel oils are dealt with and the handbook is concluded by appendices giving definitions of power plant terminology, some aspects of engine performance, with general information and a summary of formulæ, equivalents and constants.

Courses on European Trade

Considering the important repercussions which the formation of the European Common Market will have on British industry, it is regrettable that the subject should have been so little discussed by individual firms and the public. A full understanding of the problems involved is made no less urgent by the present breakdown in negotiations. To help remedy the situation, Britain in Europe, Ltd., and the Federal Educational and Research Trust have organised an enterprising series of two- and three-day courses designed to provide business executives with a background of data and personal experience that will help them in answering questions which the creation of the new European market may present for their own firms.

The courses, which are held in London, consist of talks and discussion groups and the speakers will be drawn from Government Departments and industry on both sides of the Channel and from the Commonwealth. Courses of special interest to the electrical industry to be held in the New Year will cover domestic appliances (18th to 20th February); fuel and power (15th to 17th April) and the engineering industries (13th to 15th May). Further details can be obtained from Britain in Europe, Ltd., 61, Catherine Place, London, S.W.1.

Computer Booklet

An illustrated booklet giving an introduction to the Perseus computer has been published by Ferranti, Ltd., West Gorton, Manchester, 12. The main features of the equipment are described, with details of its capacity and the methods of data input and output, followed by principal dimensions and power requirements. Copies of the booklet are obtainable from the company at either the above address or at 21, Portland Place, London, W.1.

Electron Microscope

A Type EM6 electron microscope has recently been supplied by the Metropolitan-Vickers Electrical Co., Ltd., to the Royal College of Surgeons. This equipment has been purchased for the college from funds provided by the British Empire Cancer Campaign. The instrument has a magnification of 120,000X and for critical examination of the image incorporates a binocular telescope with a further magnification of 10X.

The equipment comprises the operating desk and microscope column, with a separate cabinet for the mechanical vacuum pump, and a separate cubicle containing the power supplies for the lenses and the electron gun. A special feature is the quick release cathode assembly simplifying filament changing. Micro-setting controls enable the filament tip to be

Metrovick Type EM6 electron microscope installed at the Royal College of Surgeons

precisely centred in the cathode head and a two-stage electromagnetic condenser lens enables the illuminating beam to be controlled to fine limits.

Indian Railway Contract

The B.I.C.C. Group has been awarded a contract by the Indian Railway Board for the design, supply and installation of 25 kV, 50 c/s single-phase overhead equipment. The approximate value of the contract is £2,500,000, of which about 60 per cent will be spent in Indian currency on locally manufactured materials and local staff and labour costs, while about 40 per cent will be on materials to be supplied from the United Kingdom.

The lines to be equipped are near Calcutta on the main line to Bombay on the South Eastern Railway; they lie between Tatanagar and Rourkela, together with the branch from Rajkharswan to Dongaposi. The length of the track to be electrified is about 420 miles and the route links the iron ore fields in Bihar with the existing steel plant at Tatanagar, and the new plant under construction at Rourkela.

The copper catenary and contact wire will, in most cases, be supported from steel masts by means of hinged cantilevers which allow along-track movement. The tension in the conductors will be kept constant by means of balance-weights, thus giving a level contact wire suitable for good current collection at high speeds.

The Indian Railways have decided to standardise their future electrifications on the 25 kV, 50 c/s single-phase system. Work on the new contract is to begin immediately and is due to be completed in June, 1960.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 12th December is deemed to be 194s.

The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 12th December is 180·2 (1949=100) and 116·1 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 187·6 (1949=100) and 124·8 (1954=100), blast furnaces and iron and steel melting and rolling (40 and 41) 190·7 (1949=100) and 129·9 (1954=100); figures are provisional. The price of ⅜in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 12th December) is 46¼d per lb.

Association of British Machinery Merchants

At a meeting held in London on 4th November, which was attended by representatives of over fifty machinery merchants, an association with the provisional title of the Association of British Machinery Merchants was formed with Mr. H. Vernon (Thos. W. Ward, Ltd.) as president. The main objects of the Association are to foster and protect the machinery merchant trade; to secure the co-operation of merchant firms on a national basis who are not solely catered for by an existing organisation in their particular sphere; and to co-operate with existing machinery merchant organisations in particular spheres of the machinery merchant trade on matters of mutual interest.

The secretary of the Association is Mr. C. W. Allen, 100, Park Street, Grosvenor Square, London, W.1, from whom full particulars can be obtained.

Works Visit

Added interest was given to the visit of Major-General B. M. Hoffmeister, Agent General in the United Kingdom for British Columbia, to the Rugby Works of the British Thomson-Houston Co., Ltd., on 10th December by reason of the recent formation of the Peace River Power Development Co. to harness the Peace River, British Columbia. It will be recalled that in 1957 the B.T.H. Export Co. was appointed technical adviser in respect of generation, transmission and utilisation of electrical energy in the Peace River area.

During his visit to Rugby, Major-General Hoffmeister, who was accompanied by Mr. E. V. Small (director, B.T.H. Co., and managing director, B.T.H. Export Co.), was entertained to lunch by Mr. E. H. Ball (managing director, B.T.H.) and other directors. In his tour of the works, Major-General Hoffmeister was joined by Mr. H. E. Cox (director, B.T.H., and general manager, Rugby Works). The visit took in the germanium, fabrication, heavy plant, and turbine factories.

Pressed Steel Co.'s Achievements

An elaborate and profusely illustrated book has been issued by the Pressed Steel Co., Ltd., in which it records some of its achievements in the motor car, railway wagon and refrigeration industries. The book is apparently intended for wide circulation as the text and the captions to the illustrations are printed in a number of languages.

Calendars and Diaries

Stewarts & Lloyds, Ltd., have again sent us their neat desk calendar which has monthly slips.

"Outward Bound," a picture of a sailing vessel leaving harbour, has been selected by the Liverpool Electric Cable Co., Ltd., for its calendar which has monthly slips showing also the preceding and following months.

The calendar of Mavor & Coulson, Ltd., has a colourful picture of Gruinard Bay, Western Ross.

The pocket diary received from Marconi Instruments, Ltd., contains a number of pages of useful technical data of particular interest to radio engineers. It is bound in navy blue soft leather.

The large monthly sheets of the calendar of Monsanto Chemicals, Ltd., have views taken at the company's works. Each sheet also shows the preceding and following months.

The useful calendar received from Panelec (Great Britain), Ltd., has monthly slips for the preceding, current and following months, and also shows at a glance the complete calendars for 1958, 1959 and 1960.

"Through the Village" is the title of the attractive picture selected by Gilflex Conduits, Ltd., for its calendar which has monthly slips.

The calendar of British Insulated Callender's Cables, Ltd., is mounted on a strong board and shows the calendars for 1958, 1959 and 1960, as well as monthly slips for the current, preceding and following months.

Excellent coloured views of beauty spots in Great Britain again adorn the monthly sheets of the calendar produced by C. A. Parsons & Co., Ltd.

George Bray Progress

The history of George Bray & Co., Ltd., has been recorded in a well-produced brochure which the company has issued. This commences in 1863 when the founder of the company produced a porcelain-tipped gas lighting burner, and then briefly describes the company's development up to the present day with its four divisions covering gas burners, insulators, electric heating and (by its subsidiary, Bray Accessories, Ltd.), components of a wide variety from escapement wheels to miniaturised electronic components.

Trade Announcements

British Insulated Callender's Cables, Ltd., announces that its Norwich branch office has moved to 56, Pitt Street, Norwich (telephone: Norwich 21526). The Cardiff office is moving on 22nd December to Station Terrace, Queen Street, Cardiff (telephone: Cardiff 24716).

Butyl rubber insulated ships' wiring cables are now available from **Mersey Cable Works, Ltd.** They are supplied with up to six cores in accordance with B.S. 883 for natural rubber insulated cables.

FitzGibbon & Murray, Ltd., announce that their representative for Lancashire, Cheshire and the North Wales coast is now Mr. M. C. Toner, 17, Douglas Road, Hazel Grove, Stockport.

Desoutter Brothers, Ltd., now offer their portable electric power tools for sale direct to the retail market. The first four main distributors have been appointed; they are Buck & Hickman (London and all branches), A. J. Howard (Southend), G. A. Robinson (Stoke-on-Trent and Coventry) and Power Tools, Ltd. (Birmingham and London).

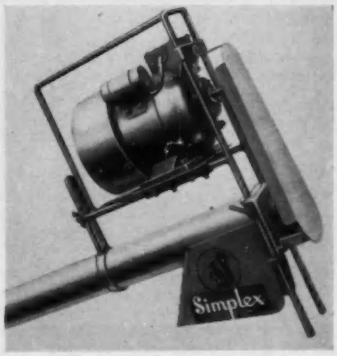
Smithfield Show

AFTER the wet summer experienced this year farmers visiting the Smithfield Show and Agricultural Machinery Exhibition at Earls Court, London, last week, must have found the exhibit of the British Electrical Development Association of more than usual interest. By using equipment, samples, photographs and displays, the Association showed that for drying grain or grass, in bulk or batch, electricity has the answer. Five different methods of drying by electricity were displayed. These included tray dryers in which one to three tons of grain at a time can be dried loose; platform grain dryers for the drying of grain or seeds in sacks; in-silo types, for drying grain harvested and stored in bulk; and dual purpose crop drying by either platform or tunnel methods. Baled grass can be put on to a platform in batches of 4-5 layers deep or built up to form a hollow tunnel into which ventilating air is blown. Grain can be dried in sacks, or even loose, and this method of drying can be applied to any size of farm. With barn hay drying, the drying costs are said to be as low at 12s 6d per ton. Another section of the E.D.A. stand dealt with equipment for the mechanical handling of grain, and instruments for moisture determination.

A comprehensive range of electrical equipment specially applicable to farming interests was to be seen on the British Thomson-Houston Co.'s stand. Included in the display was the company's "Stayrite" single phase power drive which is rapidly becoming standard equipment on an increasing number of farming machines. This form of drive, consisting of a motor and starter designed as a composite unit, is in ratings from 2 to 5 h.p. The motors can be either of the protected-enclosure or totally-enclosed, fan-cooled type and either hand-operated or pushbutton starters can be provided. There was also to be seen a wide selection of f.h.p. motors of the type used for farm and dairy appliances. The advantages of the cleanliness and safety of infra-red dull-emitter heaters for pig and poultry rearing were demonstrated on another section of the B.T.H. stand, while other exhibits included industrial heaters for sterilising, water heating or space heating purposes.

Infra-red animal warmers, of G.E.C. manufacture, were shown on the Simplex Dairy Equipment Co.'s stand, as well as a range of potato chitting equipment.

Introduced by Agricultural Supplies (Cambridge), Ltd., an auger grain elevator was shown on the Simplex stand. Employing a seamless steel tube, it consists of a basic unit 11ft long with 5ft 6in extensions and can be used where it is not possible to operate an auger of fixed length. The grain outlet chute is specially shaped to ensure a steady grain discharge when the auger is used at different angles, while the intake is provided with an adjusting shoe to control the grain throughput.



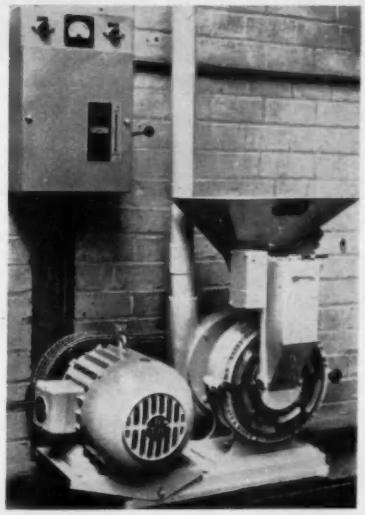
Simplex auger grain elevator

A ¾ h.p. motor is recommended by the manufacturers for the 11ft and 16ft 6in machines but for the larger 22ft size a 1½ h.p. motor is necessary. The company's display also included the Simplex expanded metal drying and storage silo, claimed to be the only one awarded four silver medals at national agricultural shows.

On the C.A.V. stand was a representative selection of electrical equipment for agricultural tractors and for stationary and portable engines, including starters, dynamos, control boards, lamps, batteries, etc. Among the last mentioned was a new thin plate high performance type of lead-acid battery, with patent porous rubber separators with glass wool pads against each positive plate. There was also a wide range of electrical equipment for tractor and agricultural machinery use on the stand of Joseph Lucas, Ltd.

More manufacturers of refrigeration equipment are choosing the Smithfield Show to display their goods, possibly because of the farmers' growing interest in frozen foodstuffs and in the advantages of preserving fresh foods for all-the-year-round use. One newcomer to the section was Lec Refrigeration, Ltd., who, apart from their smaller domestic refrigerators, showed home freezers, conservators, display cabinets and a 4·2 cu ft bottle cooler. Among the

Below: E.D.A. stand at the Smithfield Show. Right: A 3 h.p. Christy and Norris automatic hammer mill operated by B.T.H. "Stayrite" single-phase equipment



refrigerator display and sales cases shown by Prestcold were several new models, including a three-quarter view display counter for cooked meats, etc. The company also displayed a 150 cu ft "Cleanline" meat coldroom complete with the Prestcold "Defrostermatic" automatic hot-gas defrosting system. Marco Refrigerators, Ltd., exhibited a similar sized coldroom complete with automatic defrosting equipment and here the accent was on medium temperature display and storage cabinets with equal appeal to butchers' shops or self-service stores. Of interest to frozen food retailers was the "Marcold" cabinet, an 11 cu ft model which occupies relatively little floor space.

Other refrigerator manufacturers represented were J. & E. Hall, Ltd., who showed their "Hallmark" flake ice maker, capable of producing one ton of ice per day; Frigidaire, Ltd., who showed frozen food storage and display cabinets, service cabinets and a limited range of household refrigerators; and Kelvinator, Ltd. The last-named company had on view the "Crystal Tips" automatic ice making machine powered by a Kelvinator ½ h.p. hermetically sealed refrigeration unit. It produces in excess of 5,000 tips or 10,000 chips of ice per day and has storage space for up to 170 lb of ice.

A new spear type mounting post for electric fencers was shown by Wolseley Engineering, Ltd. Also new on this stand was a "D" shaped battery box which is claimed to be able to accommodate any type of fencer battery now available in this country. With this new box there was shown a British made air depolarising long-life dry battery of high capacity which has been specially designed to meet competition from overseas. The "Koltec" electric fencer, manufactured in Holland, was to be seen on the stand of Curtis, Padwick & Co.

London Board's Scrap Metal

IN our last issue we summarised the report by Mr. H. Benson on the London Electricity Board's system of disposing of scrap cable and other materials. We appended a note on a letter sent to *The Times* by Mr. H. J. Randall, former chairman of the Board, in which he suggested that Mr. George Strauss, M.P., who caused the matter to be raised, should withdraw his accusations and express his regret to the Board.

On the following day Mr. Strauss replied to the effect that when he raised the subject with the Minister of Power the Board should have replied to the complaint. As it did not but, instead, threatened him with a libel action, the members had only themselves to blame if they had "lived for many months under a stigma." He further said that his solicitor had expressly informed the Board's solicitors that Mr. Strauss was satisfied that the practice complained of was in no way attributable to any improper conduct of the Board or its officials. Mr. Strauss concluded by saying that if any apology was called for it should be for the Board to apologise to him.

To this the Board's solicitors (Messrs. Sydney Morse & Co.) replied that the Board did not consider at that time that Mr. Strauss's disclaimer was sufficient. In the same letter he stated that the practice in question was "the result of obstinacy and folly and nothing more." This "ungracious and limited withdrawal was not acceptable" and the Board was advised to commence proceedings to vindicate itself and its employees.

A.P.L.E. Section Meeting

AT the seventh sessional meeting of the South Western Section of the Association of Public Lighting Engineers held at Exeter recently, Mr. S. Hartland, M.B.E., was inducted as the new chairman and two papers were presented. The first paper was by Mr. J. Brierley, city engineer of Exeter, who said that Exeter was engaged in a considerable scheme for the re-lighting of its streets, the basic principles of which were fluorescent lighting in the centre of the town and mercury vapour lighting along the traffic approaches. In the second paper, on new light sources, Mr. D. H. Holloway (Philips Electrical, Ltd.) referred to a 250 W sodium vapour lamp having a light output of approximately twice that of the usual 140 W sodium lamp and having an integral jacket. He also dealt with the substitution of quartz inner tubes for glass ones in high pressure mercury vapour lamps, giving approximately 25 per cent more light owing to the higher gas pressure. The range of fluorescent high pressure mercury vapour lamps was also discussed.

NEW IDEAS FOR THE POULTRY FARMER

TWO new devices seen at this year's National Poultry Show organised by *Poultry World* and the *Farmer & Stock-Breeder* and held at Olympia last week were concerned with avoiding loss through power failures. One, which received a silver medal award, was the "Contax" alarm made by Millers Works, Ltd., Tedburn, Exeter. The combined unit serves as a burglar alarm and also gives warning of electricity failure in the incubator house, brooder house, etc., an illuminated indicator on the master unit showing which particular house is concerned. Alternatively, the unit can be supplied for mains failure only. It is battery operated.

The second type of appliance was the heat-storage brooder, the insulation of which avoids risk from power cuts and also enables electricity to be taken at off-peak rates. Examples were shown by Purlac Equipment, Ltd., Hailsham, Sussex, and Curfew Appliances, Ltd., Ottershaw, Surrey. The latter concern also exhibited a new cabinet incubator having four separate setting chambers each with wet and dry thermometers and an automatic humidifier.

Another silver medal winner was the semi-automatic dry cleaning machine shown by Martin Watson, Thornhill, Ltd., Buxton, which can deal with 1,500 eggs an hour. A simple device of this kind shown by Black & Decker, Ltd., Harmondsworth, consists of an egg cleaning attachment for the company's portable electric tools. Other applications for portable tools were also demonstrated.

Said to be the largest factory-built incubator in the world, the "Chick Master" exhibited by Western Incubators, Ltd., East Hanningford, Chelmsford, can incubate 93,240 eggs at a time. Hatching progress is checked from the outside by indicator lights and recorder chart.

An automatic poultry feeder shown by Cope & Cope, Ltd., Reading, uses the conveyor belt principle. It comprises a master feed bin, which is filled periodically; attached to this is a power drive which propels a continuous chain conveying food along specially constructed troughing.

Inspiration and Integration

MR. W. M. LARKE'S address as president of the Junior Institution of Electrical Engineers was delivered in London on 12th December. Taking as his subject "Inspiration and Integration," Mr. Larke spoke of the 75 years covered by the life of the Institution. Outlining some of the difficulties encountered and achievements attained through their persistence by such men as Sir Charles Parsons, Col. R. E. B. Crompton and F. W. Lanchester during the latter part of the 19th century, he said that their work demonstrated that, having had the initial inspiration, they had integrated their efforts in a wide variety of fields to achieve results. Nowadays the most fertile fields in engineering had proved to be those in which several branches of science had combined.

Mr. Larke then dealt with ergonomics and also the applied psychological research into fatigue and boredom carried out by the Medical Research Council, and he concluded by discussing the necessity for engineers to have the broadest possible education since they must understand the implications of their work on society in order that they themselves might be understood by society.

TUNGSTEN LAMP DEVELOPMENT

New Laboratory Opened at Osram Works, Wembley

A LABORATORY for the development of incandescent lamps has recently been completed at the Osram Lamp Works of the General Electric Co. at Wembley, Middlesex. These new quarters combine, under one roof, facilities which have until now been shared by both the Wembley and Hammersmith works. The laboratory has a floor area of 6,500 sq ft and a staff of 34 is occupied with the development of new lamps and improvements to existing designs and their manufacturing processes. Research work into new types of lamps is, however, carried out in the separate G.E.C. research laboratories at Wembley and development work on lamp-making machinery is done in another laboratory.

Development of a new type of lamp entails the manufacture of a " hand-made " prototype and a new lamp is put into production only if methods have been found of producing it satisfactorily at an economic cost to the manufacturer and the consumer. New developments undertaken at the laboratory recently include the " Lilliput " miniature Christmas decoration lamps, new high power reflector spotlights for theatre lighting, new design of fuses for general service lamps, high power quartz lamps, a new design of fuse for projector lamps and new reflector projector lamps.

Tungsten Lamps

Development in the general field of tungsten lamps is being actively pursued, particularly with regard to the quality control of manufacturing processes. Minute quantities of harmful gases evolved from the glass bulb during the life of the lamp affect the performance and the risk of contamination of the filling gas during manufacture is one processing fault which cannot be covered by the tests made in the production sections. Daily tests are therefore made in the laboratory on test lamps with special filament formations. From careful measurement of the cold resistance of the filament during the first few hours' burning an accurate assessment can be made of any contamination present. The apparatus used for these tests is shown in Fig. 1. The general shape of the resistance curve obtained from these tests can be interpreted to show whether the contamination consists of oxygen, water vapour or oil.

The behaviour of tungsten filament lamps under vibration is measured by a stroboscopic equipment in conjunction with an electromagnetic transducer driven by a variable frequency oscillator. The filament must be supported in such a way that the effect of natural resonance will be minimised. Good performance under vibration also depends on the correct treatment of the tungsten powder during manufacture.

For shock testing, a prototype rough service lamp is securely mounted in a cradle which is dropped on to a hardened steel plate. Repeated shocks under careful control of amplitude and frequency are applied to the lamp until failure occurs. Measurements of the electrical characteristics of the lamp during its life are made and these give an indication of the behaviour of the filament. Information from these tests is used in the

Fig. 1.—Measuring the cold resistance of test lamps immersed in a constant temperature bath

Above: General view of the lamp development laboratory at Osram works

Fig. 2.—Projector lamp with internal ellipsoid mirror which replaces the conventional backing mirror and condenser lens

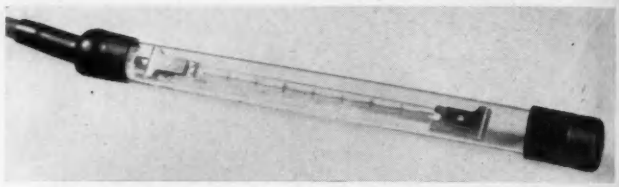


Fig. 3.—An experimental under-water hand lamp using a 1 kW quartz tubular lamp

development of more rugged lamps for general lighting service.

For rough service lamps it has been usual to provide a two-tier filament with 18 supports but this form of construction was too complicated for mass production and the filaments had to be mounted by hand. The work carried out on vibration and shock testing has enabled the laboratory to develop a simple "single-wreath" design of filament which uses only nine supports without losing any robustness.

The laboratory carries out continuous investigations into the methods of mass production and a number of machines have been installed in the laboratory to simulate a production line. On these machines the various parameters controlling the quality of the product can be varied and the information obtained is used to ensure that the production processes are operating at the optimum level.

New Types of Lamp

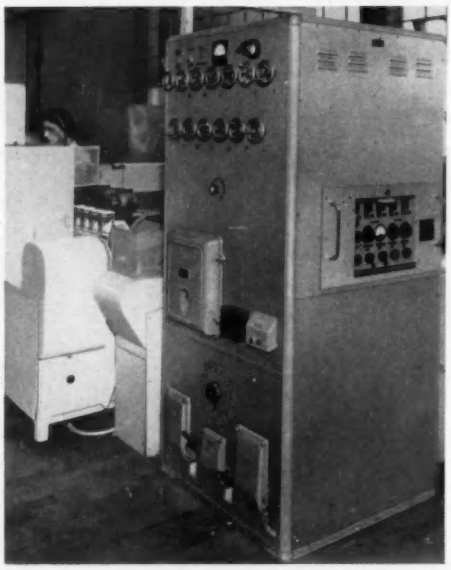
One of the recent achievements of the laboratory has been the 8 V, 50 W reflector projector lamp which incorporates a special bulb with one surface precisely shaped as an ellipsoid (Fig. 2). This surface is silvered and concentrates an image in the gate of an 8 mm cine-projector and obviates the need for a backing mirror and condenser lens system. The illumination obtained from this 50 W lamp is equivalent to that achieved by a high powered 500 W projector lamp with mirror and condenser lens system.

The laboratory has completed development of two main types of quartz tubular infra-red heaters which are now in production. These heaters have led to development work on new lamps utilising a quartz envelope. With suitable redesign, efficiencies and lives comparable with conventional projector lamps can be achieved. Lamps of this type are already finding application where their compact form has a linear source and their ability to withstand high ambient pressures and temperatures are important. For example, experiments are being carried out on a new design of underwater hand lamp (Fig. 3). Considerable research and development work has still to be undertaken and it may be several years yet before the new high efficiency tungsten filament quartz light sources become available.

Fuses in projector lamps present several design problems, particularly in the case of the modern types fitted with a small bayonet cap. In these lamps, the small space available in the caps prohibits the use of conventional fuse arrangements and this problem has been solved by using a fuse element between pinch and cap which is surrounded by a resin containing a component which foams during manufacture. This fills the cap and surrounds the lead wire with a material having a honeycomb structure which in effect provides the lamp with an h.r.c. fuse.

For many years Osram g.l.s. lamps have been fitted with two fuses, but a single fuse arrangement is now being developed. Another development includes double-filament headlamps which incorporate a shade to prevent back reflection in drizzle.

Automatic lamp testing apparatus installed at the final stage of a lamp manufacturing group



Transatlantic Communications

A PAPER entitled "Bridging the Atlantic" was read on 10th December before the Radio and Telecommunication Section of the Institution of Electrical Engineers by Mr. A. H. Mumford, O.B.E., B.Sc.(Eng.), M.I.E.E. It was a hundred years ago that the first messages were cabled across the Atlantic but this cable failed after only four weeks' use. In 1901 the letter "S" was faintly heard in Newfoundland from a radio transmitter in Cornwall but it was not until six years later that the first commercial radiotelegraph service across the Atlantic commenced. The transatlantic radiotelephone service was opened to the public in January, 1927. In 1956 the first telephone cable system was opened. It provides 36 telephone circuits and uses separate cables for each direction of transmission. Mr. Mumford surveyed the future of transatlantic communications.

In the informal discussion which followed the lecture, one questioner wanted to know what it was that made people hesitate to use transistors in transatlantic cables. Mr. Mumford replied that he would be all in favour of their use once he could be assured that the same degree of reliability could be obtained as with valves.

Alleged Fraud on London Electricity Board

AT the Guildhall (London) Magistrates' Court on 9th December Frank Hazelwood, of Worcester Park, Surrey, George Richard Bovington, of Battersea, and Joseph Walter Woolley, of Hove, appeared on summonses arising out of work done at the Southampton power station. The Maybridge Construction Co., of Brixton Hill, London, S.W., was also proceeded against. Hazelwood was charged, as an agent of the London Electricity Board, with unlawfully issuing an invoice from the company for £116 3s 9d which was false in a material particular with intent to deceive his principal. The two other men and the company were alleged to have aided and abetted. There were further charges relating to the obtaining of a cheque for £589 6s 1d from the London Electricity Board and to the alleged forging of time sheets.

Counsel for the prosecution said that Bovington was managing director of the Maybridge Construction Co. and Woolley a director and secretary, while Hazelwood was site manager for the Electricity Board and a shareholder in the company. In 1957 while work was proceeding at the Southampton power station it was found necessary to do some work on a cable. The cable company undertook responsibility for the work but two men, J. Hayter and J. Cummings, were taken from other work on which they were engaged to attend to the cable. Time sheets put in by Hazelwood showed, however, that they were still engaged in the other work. In addition to their wages, Hazelwood paid the two men, Electricity Board employees, £15. Later the company sent the Electricity Board an invoice for £116 3s 9d for the cable work. This amount was paid by the Board.

When the case was resumed on 10th December counsel for the company said that the company was formed in 1957 at a time when the Electricity Board was experiencing labour difficulties. It had dealt successfully with that problem and its contracts had been of great benefit to the Board. Never had the company intended to gain or gained any unfair advantage or profit.

The Magistrate (Sir Frederick Hoare) held that there was no case against the defendants of issuing false documents and dismissed the summonses relating to this. On the other counts all the defendants were sent for trial at the Central Criminal Court; they were allowed bail. An order was made that the Director of Public Prosecutions should be empowered to present a bill of indictment against the company.

Shaftesbury Avenue Shutdown

THE circumstances which led to the electricity supply failure in a small section of the London Electricity Board's area north-east of Piccadilly Circus on 14th October are described in a report just received.

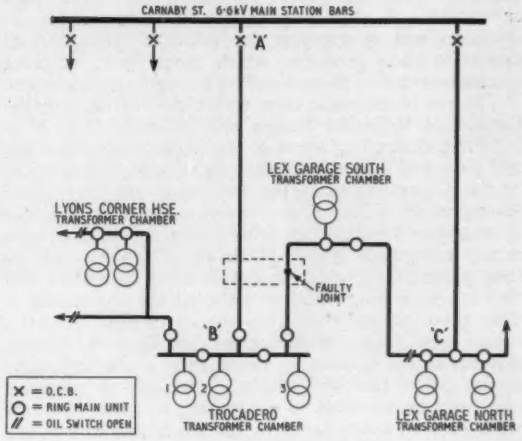
Shortly before noon the oil circuit-breaker marked "A" in the accompanying diagram tripped owing to the operation of a protective relay. The sequence of operations was then as follows: The isolator at "B" was opened manually, the oil circuit-breaker "A" was reclosed and tripped again immediately and the isolator at "C" was then closed, restoring supply to the transformer chambers at Lex Garage South, Trocadero and Lyons Corner House. A certain amount of readjustment was made to the ring, the break at "C" at Lex Garage North being moved to the other side of the transformer to enable the other two feeders to take a greater share of the load, and then an inspection started of the pits through which the feeder from Carnaby Street to the Trocadero runs.

It was discovered that the cover to the pit in Gt. Windmill Street by Archer Street was disturbed, and there also was a report of an explosion there. An inspection inside the pit revealed that a large hole had been blown in the sleeve of a joint on an h.v. cable and the conductors were bare and visible through the hole. There was over a foot of water in the pit (though not covering the cable) and arrangements were made to pump this out.

Later an engineer with a foreman, a jointer and his mate, and a labourer entered the pit with the object of repairing the visible fault. The engineer applied a pressure detector to the exposed cores of the cable just to demonstrate to the jointer that the cable really was dead. Unfortunately, it was alive, and because of the mechanical disturbance caused to the cable the fault re-developed and an explosion resulted. The engineer and the foreman were burnt by the flash and the others received slight burns and some shock.

In the calm light of subsequent analysis it is obvious that the visible faulty joint was alive, and was not on the feeder between Carnaby Street and the Trocadero, but was on the cable between the Trocadero and Lex Garage South transformer chambers; both cables ran through the same pit.

The assumption made that the Carnaby Street-Trocadero



Distribution diagram

h.v. cable was faulty because the oil switch at "A" opened again immediately it was reclosed was wrong—in fact the breaker merely failed to latch—but when that assumption was made its apparent correctness was confirmed in the minds of the operators when the oil switch at "C" was closed and the section remained alive, and it was more than unfortunate that the fault occurred in one of the three pits common to both cables. Once the re-opening of the circuit-breaker had been taken to indicate the faulty section of h.v. cable the accident was inevitable. Again, whatever method had been adopted to demonstrate that the cable was dead would have resulted in mechanical disturbance sufficient to re-establish the fault.

It is hoped that everyone reading this account will realise that however badly damaged a cable appears to be, whether l.v. or h.v., it may be alive and, if it is, it is very dangerous indeed.

Industrial Design in Engineering

The place of industrial design, and the functions of the industrial designer, in the engineering industries are discussed with reference to the papers presented at a recent conference organised by the Council of Industrial Design

MANY engineers regard the industrial or "appearance" designer with suspicion. They think of him as a young man of artistic temperament, a self-appointed arbiter in matters of taste, who produces pretty pictures of equipment that are quite impracticable to produce economically. Their view has no doubt been confirmed by the fact that industrial or appearance design is at its most ostentatious when wrongly applied, when it is used (often by themselves) to "doll up" an otherwise satisfactory engineering product. They also no doubt view with apprehension the entry into their field of someone they associate with such things as interior decoration and ultra-modern furniture where the designer has a greater freedom to exercise his imagination.

That such suspicion is unfortunate and largely unwarranted was convincingly demonstrated at a recent conference in Birmingham at which leading executives of four major engineering companies, one of them German, presented papers in which they spoke with enthusiasm of their experiences in using industrial designers and of applying the principles of industrial design to their products, which range from weighing machines to power presses and high-voltage transformers.

The aim of the conference, which was organised by the Council of Industrial Design, was to study the role of industrial design in relation to the engineering industries, and it marked the beginning of a more concentrated effort by the Council to make the services it can offer better known in this field. The conference drew an audience of managing directors and other senior people from over ninety companies in the Midlands, which is itself an indication of the growing feeling in many companies that they are not paying sufficient regard to the appearance of their products and their convenience in use. An even bigger gap exists, according to Sir Gordon Russell, director of the Council, in formulating a comprehensive design policy that will enable a company to project a clear picture of itself in everything it does. But the willingness to learn shown by the attendance at the conference is encouraging.

Good Design is Good Business

The general design of a product is becoming increasingly important in maintaining Britain's reputation for quality goods. In overseas markets, as Lord Mills pointed out in his opening address, a buyer often has to judge from a specification and a brochure and, if all other things are right, appearance may then be the determining factor. "An efficient machine should be designed to please the eye and give promise of its performance." Such a machine may be bought even when it is slightly more expensive than its equally efficient, but less attractive, competitor. Mr. John Anderson, manager, Power Press Department, Vickers-Armstrong (Engineers), Ltd., expressed it thus: "To remain in the world market, and keep on top, we must be more than first-rate engineers, we must be stylists in our own branches of engineering."

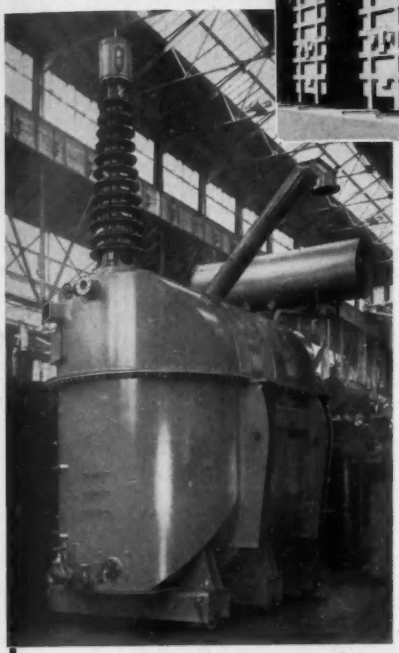
Improvements in design and appearance are also being brought about by customers' demands for better looking equipment which will not detract from the amenities of new buildings. Electrical switchboards are increasingly placed in exposed positions where colour and a smooth and well-proportioned outline are most desirable, and in the factory the appearance of machines is an important factor in improving working conditions and efficiency. Mr. L. Schuler, managing director, L. Schuler A.G., did well to emphasise that engineering products of good functional design bring out an immediate response in people and where the highest æsthetic standards are employed they can instil a desire for higher achievement.

The attitude of a company that has employed consulting designers for twenty-five years was expressed by Dr. E. W. Seward, technical manager, W. & T. Avery, Ltd. His company, he said, feels a moral obligation to provide the best looking, as well as the most efficient products it can economically produce. "Good design is an indispensable part of civilised life and it is within the power of manufacturers to improve greatly the nation's taste and its awareness of latent pleasure to be found in using and seeing well-designed things around them." Nevertheless, the company is even more concerned with the need for full order books, and it believes that these can be maintained only by a forward-looking design policy.

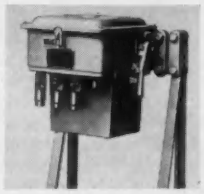
Defining Good Design

What then is good design? This question is more effectively answered by examples than by explanation and although there is space for only a few illustrations with this article they indicate the lines of development in electrical equipment. Since the most obvious improvement is the better appearance it is important to emphasise that this is only one aspect. No less important and often inseparable from it are the attention that has been given to facilitating operation and maintenance of the machine and to the use of new materials and production methods. As Mr. G. S. C. Lucas, director and chief electrical engineer of the British Thomson-Houston Co., Ltd., explained, good industrial design is the sum of good form or appearance and good engineering. Mr. Schuler emphasised that it is a most important duty of management to guard against the desire to consider external appearance before utility, and he thinks it is undesirable for a machine to be merely clothed in an external casing. Appearance must not interfere with technical efficiency but rather be an expression of it. The separate parts of a machine must form a balanced whole.

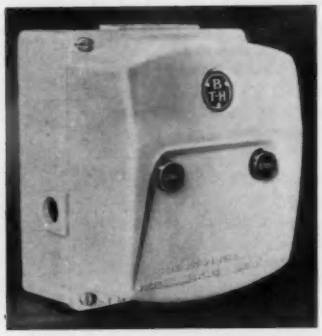
Referring particularly to a power press, he said that to have a good appearance the press must have a good functional outline. The design and arrangement of the levers and the control buttons should be such as to assist in the operation, through accessibility and by presenting a clear picture to the operator. The picture should not be confused by shafts, gearwheels, control linkages, etc.,



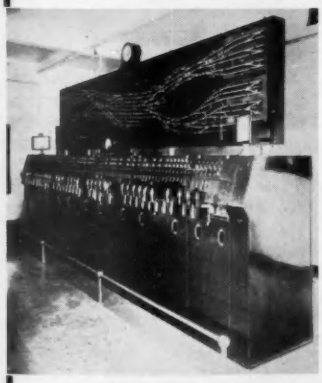
In the redesign of this Metropolitan-Vickers transformer, improvement in appearance has gone hand in hand with improvement in manufacture. In the latest design the curved surfaces not only look better but reduce weight, oil content and welding time. There have been several intermediate stages between the two units illustrated



Apart from the improved appearance of this prototype G.E.C. oil circuit-breaker, a point of interest is the way in which operation has been simplified by the provision of a longer switch handle and by the greater prominence of the "trip" button in the "clean" front panel



In addition to modification of the shape of this B.T.H. contactor starter, the lettering on the face has been reduced to the minimum



This redesigned Metropolitan-Vickers signal frame not only has greater visual appeal but meets user requirements formulated by research

which can cause accidents. Maintenance is simplified and the smooth surfaces easy to clean. Mechanisms inside the box frame are protected from dirt and the life of sliding surfaces is accordingly prolonged. These results could have been achieved, he said, by providing covers without thought of appearance. Nevertheless, the demand for good appearance was the cause of these technical improvements.

It may be argued that many of the aspects of industrial design referred to above are the province of the engineer and that they will be naturally incorporated in a product that is well designed from the engineering point of view. But experience tells us that this is not so and many a machine or piece of apparatus that is technically efficient leaves much to be desired when it comes to appearance, ease of operation and maintenance. Where the engineer is strictly limited by the specification the results often provide considerable visual satisfaction. Mr. Misha Black, senior partner, Design Research Unit, cited the examples of the aerodynamic form of high-speed aircraft and the internal arrangement of a television chassis, and contrasted them with the less satisfactory interior fittings of the one and the case of the other.

Engineers and Designers

Various reasons were given for this failure of engineering designers. One is that most products of the heavy engineering industries are the work of many specialists and there is no clear direction on what may be considered the less essential aspects of design. Changes are introduced piecemeal, and meters and other parts are bought in with little regard to their integration in the whole, so that the final product becomes a haphazard collection of unrelated objects. The form and appearance of many products is dictated by tradition and this is difficult to alter even when the reasons for it have disappeared or have no logical basis.

There is often a lack of contact between the engineering designer and the users, with a consequent failure to cater for their requirements. More fundamentally, there has been a loss of artistic direction in our civilisation and the visual judgment and sure touch of the early engineers has been vitiated. Engineers are often trained in industrial towns and old factories where there is little of beauty and little to stimulate them to recreate beauty in their own work. In some cases materials and methods of production have been a limiting factor but welding, in particular, has done much to free the designer.

It will be evident then that there is a broad front on which the industrial designer can collaborate fruitfully with the engineer, and by bringing specialised knowledge and a fresh approach to traditional problems help to materially improve the final product to the satisfaction of both. To be qualified to do this, Mr. Misha Black suggested, the industrial designer should have an understanding of mass and shape analogous to that of the sculptor and architect; an application of the emotive and motivating effects of colour and pattern; and a knowledge of lettering in the closely related terms of beauty and legibility.

The designer must be willing to battle with unrelenting tenacity for his ideas, but must not suffer from the illusion that he is always right. He must be able to communicate his opinions in drawings and language which can be understood by his colleagues in the factory and get on with them as a reasonable human being. He must also be able to relate his creative contribution to the technical conditions of the factory in which he works.

Though these qualifications develop from a kind of training, from an attitude to life and to the problems of production that differ at least in degree from the training and background of the engineer proper, Mr. Black stressed that the industrial designer is a specialist technician in his own right and should be accepted as such.

There are obvious difficulties in employing an industrial designer. He must have characteristics that differ from most of his colleagues and if he is not to lose the originality of approach on which his value to his employer largely depends he must be given special working conditions and facilities. These problems and the vexed question of whether to employ a staff or consulting designer were the subject of much discussion. It would seem to be agreed, however, that to be fully effective the industrial designer must be brought in at the earliest possible stage and the final form and appearance of the product should be settled with the aid of perspective drawings and, if possible, a model well in advance. In this way all those who are working on the product will have before them the end to which they are contributing. The importance of a design policy being approved and encouraged at board level was stressed by several speakers.

It is also desirable that engineers and draughtsmen should be trained to appreciate the contribution of the industrial designer. This point was brought out by Mr. Lucas in discussing the way in which A.E.I. are tackling appearance design. They are, he said, encouraging its evolution rather than dictating a rigid policy and they are employing successfully both staff and consulting designers. One of the most important duties of the local appearance design committees of the individual A.E.I. companies is to introduce courses of instruction. In one group of companies the emphasis is placed on the training of drawing office apprentices in industrial design and in another a series of winter lectures is given to engineers and draughtsmen.

Journals on appearance design are circulated and bulletins and photographs are displayed on drawing office notice boards. There is also an annual course for twelve engineers and draughtsmen on experimental æsthetics and this is followed by a practical course in which a design project is undertaken. In each case the aim is not to produce industrial designers but to build up a body of men who will appreciate the need for good design and apply the principles they have learnt.

A new design policy cannot be put into operation overnight, but once the need for improvement is realised steady progress will probably be made even where to start with a product cannot be re-designed from scratch. Sir Gordon Russell thinks that the heavy engineering industry has certain advantages over the durable consumer goods trades in that as a rule it deals directly with the customer. Also the engineer has always been a guardian of quality. The Council of Industrial Design is as anxious to learn as to teach, but it has already a good deal of experience in dealing with design problems and its staff, its Record of Designers and other services are at the industry's disposal. It is willing to help however small the design problem.

International Lighting Vocabulary

A NEW section covering lighting (Publication No. 50(45), 33 pages) of the second edition of the Electrotechnical Vocabulary (the first edition was issued in 1938) is now available from the International Electrotechnical Commission, 1, rue de Varembé, Geneva (10 Swiss francs). The complete edition, the production of which is financially assisted by UNESCO, is being issued in 22 parts and is expected to be ready as a whole in 1960. Definitions in English and French and terms used in six other European languages are given, with 27 pages of indices.

PARLIAMENTARY REPORT

Railway Modernisation Plan to be Reviewed

Between 3 million and 4 million tons of coal for use at power stations will be transferred from road to rail transport in the first 12 months of the operation of a new agreement which has been concluded between the Electricity Generating Board and the British Transport Commission.

This was reported to the House of Commons last week by the Minister of Transport, Mr. Harold Watkinson, during the debate on the Transport (Borrowing Powers) Bill which increases the borrowing powers of the Commission from £600 million to £1,200 million. He said this represented no sudden new injection of capital into transport finances, but merely provided Government backing for the modernisation programme which they had approved. But he made it clear that the Government would require very complete economic justification for any change in the target date of 1961-62 which was originally fixed for the Commission to break even. In this, electrification and the attraction of more freight traffic would be important factors.

The losses this year were largely due to the setback in coal and steel traffics because of the general fall in industrial activity. It was not due to a disastrous loss through competition. There had been no failure of the Commission to hold its fair share of the traffic.

An agreement recently signed by the Commission and the Generating Board would mean that about 3 million to 4 million tons of coal traffic would be regained by the railways in the first six to twelve months, and the amount would be more in the succeeding years. This was a useful attempt to get coal traffic from road to rail. At present the railway carrying of coal was down by no less than 500,000 tons a week. "That is a situation which, while it may be temporary, is nonetheless disastrous for the Commission's finances," said the Minister.

The House was being asked to advance large sums of money on a prospectus by the Commission that modernisation would pay off. On the passenger side, with the introduction of diesel services, the Commission was practising what it promised. To get more economic working it was, with Government support, taking two main lines of attack—more modernisation on a narrower front; and more savings on a much broader front.

At his request the Commission had initiated an urgent review of the whole modernisation plan which would take account of the likely changes in traffic and would try to assess the level of activity in the coal industry (particularly in view of the development of oil and the high price of coal) and future developments in atomic power. These, and other matters, could not, in all fairness, have been foreseen in 1956 when the modernisation was authorised, he said.

In electrification, the Commission proposed to concentrate its resources on the London, Midland and Scottish line to Manchester and Liverpool, and hoped to accelerate its completion by several years to get a quicker return on the capital investment. Secondly, there would be an acceleration in the introduction of diesel locomotives, to eliminate the use of steam on an area basis as soon as possible. This would apply particularly on the routes north of Newcastle. The number of multiple-unit diesel trains would be doubled from 2,300 to 4,600 by the end of 1961. The fact that the Commission would concentrate on the L.M.S. line did not mean that the electrification on the King's Cross-East Coast route or other schemes would be held back.

Automation and Employment

The Prime Minister informed Mr. Harold Davies that the effect of automation on employment had been under consideration by the National Joint Advisory Council of the Ministry of Labour (representing the British Employers' Confederation, the Trades Union Congress and the boards of the nationalised industries). He did not think a Royal Commission on the subject was called for.

Safety of Electric Blankets

Mr. Kimball asked the Home Secretary if he was aware of the number of fires and accidents caused by electric blankets, and if he would investigate this matter with a view to introducing legislation covering the construction of these devices.

Students' Fees

In reply to Mr. Albu, the Minister of Education (Mr. Geoffrey Lloyd) said that according to information supplied to him, 76 per cent of all students now in attendance at colleges who were taking a course leading to the Diploma in Technology, and 82 per cent of such students taking sandwich courses, had their fees paid by their employers.

Shortage of Places for Apprentices

Mr. Moss asked the Minister of Labour whether he was aware that the number of applicants for apprenticeship far outnumbered the number of apprenticeships available and what steps he was taking to improve the position.

Mr. R. Wood, Parliamentary Secretary, said he was aware that there was, in general, competition among young people for apprenticeships. The Industrial Training Council was in touch with industries regarding their future requirements for trained workpeople in the light of the increased numbers of school leavers becoming available. Youth Employment Committees throughout the country were bringing to the attention of local industry the need to train more apprentices.

Nuclear Installation Licensing

When the House of Lords considered the Nuclear Installations (Licensing and Insurance) Bill on recommittal, Lord Silkin moved an amendment to Clause 5 to provide that where an individual could establish his presence at the time of an accident to a nuclear reactor he should be entitled to compensation if he suffered injury or damage without any further proof on his part, unless the licensee of the reactor could prove otherwise.

Lord Mills, Minister of Power, said that the amendment breached a fundamental principle—that before damages could be awarded to one person against another the claimant must satisfy the court of the validity of the claim. After debate, the amendment was negatived by 65 votes to 35.

B.B.C. Handbook 1959

MORE than 53,000 hours of programme output was broadcast by the B.B.C.'s domestic and external sound radio and television services during the year, according to figures included in the illustrated 282-page B.B.C. Handbook for 1959, published by the B.B.C. Publicity Department, 12, Cavendish Place, London, W.1, price 5s. The handbook gives details of the size of audience served by these programmes and covers developments in international television and the use of the Eurovision link. Many of the B.B.C. engineering division's achievements are listed, and experiments in colour television, high power Band V television transmissions and stereophonic sound transmissions are described.

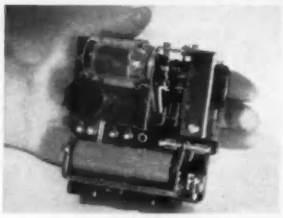
Quick-reference tables giving details of all B.B.C. transmitting stations, for long- and medium-wave, v.h.f. and television, are given and there is a map showing the situation of these stations and the numerous studio centres. Articles on technical matters cover wavelength allocation, obtaining the best reception and the work of the various engineering departments.

NEW ELECTRICAL EQUIPMENT

Photo-Electric Controller

A control unit with an operating time of 50 millisec, using a cold cathode thyratron-operated relay and incorporating 3 mm dia. infra-red sensitive cells, has been announced by the BRITISH CENTRAL ELECTRICAL CO., LTD., Briticent House, 6 & 8, Rosebery Avenue, London, E.C.1.

The "Micro-Sonde" photo-electric receiver can be supplied either mounted at the end of a coaxial screened flexible cable, or moulded in nylon and fitted to a miniature Edison screw base. The control unit is mounted in a steel case, 4in by 4½in by 2½in deep, which can be sealed to prevent unauthorised interference. The chassis is assembled on a plug-in unit, and is mounted in the sheet-steel case on a connector socket forming a terminal block for all connections. Floating contacts in the socket and



British Central Electrical "Micro-Sonde" control unit

solid pins on the chassis ensure correct alignment and low contact resistance, and when plugged in the chassis is locked in place by a stud which also completes the earth circuit. The relay contacts will break a maximum current of 5 A a.c. or 1 A d.c. and the relay will operate correctly with supply voltage variations of ±20 per cent and within a temperature range of ±40 deg C.

The control unit complete is priced at £31, and the various complementary items include a "Micro-Sonde" receiver, mounted on a screened coaxial cable, priced at £1 12s 6d to £2—depending on the length of cable employed, between 6ft and 32ft—and a projector at £1 5s.

Frequency Meter

The type 715 frequency meter announced by DAWE INSTRUMENTS, LTD., 99, Uxbridge Road, London, W.5, has been introduced primarily for measuring rotational speeds of high-speed mechanisms, and is most conveniently operated in conjunction with the type 716 photo-electric pick-up enabling such measurements to be made without mechanical contact with the moving part. Speeds from 600 to 1,800,000 r.p.m. can be registered by this meter when used as a tachometer,

Dawe frequency meter

or, alternatively, cyclic events occurring at speeds between 10 and 30,000 c/s can be investigated.

The input signal is applied to the high-impedance earthed collector input stage, and fed to a shaping and two-transistor bi-stable circuit, from which it passes through a resistance-capacitance differentiating network to a rectifier and thence to a moving-coil meter. By arranging the time constant of the integrating network to be small compared with the pulse duration of the incoming signal, the meter reading is made proportional to the signal frequency and the scale can be calibrated directly in terms of frequency.

Six frequency ranges are employed, 100 and 300 c/s and 1, 3, 10 and 30 kc/s, the accuracy in each range being ±2 per cent of full-scale deflection. The meter can be operated either from self-contained dry batteries or from the supply mains and the switch selecting the appropriate power supply has an additional test position for checking the state of the batteries.

Sleeve-Fitting Tool

The bench-mounted tools, types SKB and SB, for fitting binding and identification sleeves to cable ends are

Hellermann pneumatic sleeving tool

now available arranged for pneumatic operation, reducing operator fatigue and giving an increased operating rate. Adjustable rings prevent sleeves being overstretched, and a reduction valve is fitted enabling the tool to be used with any air line. Further details are available from the Cable Accessories Division of HELLERMANN, LTD., Crawley, Sussex.

Lighting Fittings

An attractive but inexpensive range of lighting fittings, designed by Beverley Pick Associates, is now being marketed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Named the "Gaylon" range, it consists of elliptical enclosed fittings, moulded from rigid p.v.c., and includes two sizes of pendant fitting and a table standard.

The pendant fittings measure 11in and 16½in in diameter respectively and accommodate either a 60 or 100 W lamp. The table standard consists of a simple black wire frame to which the 11in diameter fitting is attached. It is supplied complete with a suitable length of flexible, a torpedo switch and an attractive lifting handle which extends through the top of the shade.

There is a choice of three colour

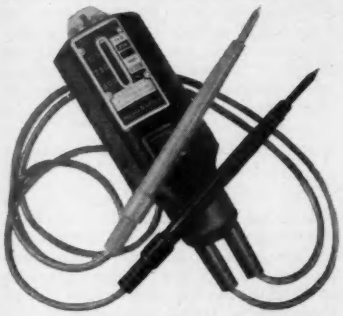
Table standard and pendant from the G.E.C. "Gaylon" range

combinations. Top bowls are obtainable in red, cream or white and the lower bowls for each colour comprise white diffusers. The white diffuser is secured to the coloured top bowl by an external detachable polished brass ring. The fittings are said to be easy to clean and can be fitted to existing lampholders without difficulty.

The prices of the pendant fittings are £1 9s (11in) and £1 19s 11d (16½in), while the cost of the table standard is £3. All prices are inclusive of purchase tax.

Voltage Tester

A compact lightweight multi-purpose voltage tester having only one moving part—a solenoid type indicator moving against a beryllium copper spring—has been announced by SQUARE D, LTD., 100, Aldersgate Street, London, E.C.1. Suitable for operating from 110 to 550 V a.c. 50 c/s



Square D voltage tester

or from 125 to 600 V d.c., the tester incorporates an audible indicating device operating when a.c. voltages are being measured, and gives a visual indication of polarity when a d.c. supply is being examined. Each test prod contains a current limiting resistor and replaceable fuse, and receptacles on each side of the moulded plastic case, which is insulated to withstand 10 kV, can be used to hold the prods while testing or to house them when the instrument is not in use.

High-Sensitivity Instrument Tube

A high-brightness, high-sensitivity instrument cathode ray tube, type DH10-78, employing helical post-deflection acceleration, has been announced by MULLARD, LTD., Mullard House, Torrington Place, London, W.C.1. The tube, which has a 4in diameter flat screen and an overall length of only 12in, uses electrostatic focusing and deflection, and is suitable for double symmetrical operation.

The post-deflection accelerator consists of a high-resistance coating applied in the form of a helix to the inside of the bulb, providing a continuous gradient of acceleration voltage, rising from a relatively low value near the deflector plates to a high final value. Pattern distortion is thereby minimised, a higher p.d.a. ratio, up to 4 : 1, may be used, and the pre-deflection acceleration may be kept low to ensure high sensitivity, while the final accelerating voltage may be made high to obtain maximum brightness.

Under typical operating conditions "X" and "Y" sensitivities of, respectively, 30 and 10 V/cm can be achieved with a post-acceleration voltage as high as 4 kV. The shield between the two pairs of deflection plates is brought out separately, permitting adjustment of the shield voltage to correct pin-cushion and barrel distortion.

Designed specifically for oscilloscopes, the screen of the DH10-78 is coated with a high-sensitivity sulphide phosphor giving a bright actinic display. Under normal excitation conditions the blue and yellow components give a green/white fluorescence of medium persistence.

Domestic Refrigerators

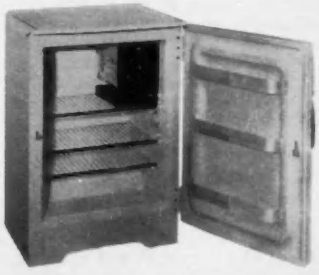
A recent announcement from the LIGHTFOOT REFRIGERATION CO., LTD., Abbeydale Road, Wembley, Middlesex, states that the company is now marketing in this country a range of refrigerators manufactured by the Linde organisation in Western Germany. All cabinets in the new range have a large internal capacity in relation to their external dimensions. This has been made possible by the design of the sealed compressor units and flue type condensers with which the cabinets are equipped. The internal layout of all models provides for the storage of generous quantities of frozen foods. They also contain vegetable containers which are covered by plate glass lids, giving extra shelf space.

The larger models in the series are equipped with a transparent plastic sliding drawer for raw meat or fish. Each refrigerator cabinet has one or more sliding shelves, other shelves being of the lift-up type. Racks of various sizes designed to accommodate eggs, bottles, tinned foods, etc., are built into the inner door.

The two models in the range which are available for immediate delivery are the LH.16 (5·6 cu ft) and the LH.26 (9·2 cu ft). The external finish of the cabinets is of white enamel, a distinctive "Lightfoot" badge decorating the domed door. The handle is of the slam lock type, working on a nylon catch, and is finished in chromium. The storage compartments are of one-piece construction, with rounded corners to facilitate cleaning, finished in white vitreous enamel. These first two models are priced at £90 5s 6d (LH.16) and £150 9s 10d (LH.26), including purchase tax.

Two new household refrigerators have also been announced by the FRIGIDAIRE DIVISION OF GENERAL MOTORS, Stag Lane, Kingsbury, London, N.W.9. They are the models MZ-45 and DZ-45, which, with a gross capacity of 4·4 cu ft, are available in six model variations. Both are being produced for free-standing or for building in and the de-luxe (DZ-45) model is available also with a choice of left- or right-hand door opening. The exteriors have been re-styled and now have a streamlined appearance, while the interiors are finished in white and light blue with fittings in contrasting dark green. Shelf space in both models has been increased. In the door store of the MZ-45 there are now three shelves and in the cabinet the shelving is so arranged that the most awkward items of food and drink can now be accommodated. The de-luxe DZ-45 incorporates a new style door and kick plate and is available in exterior colours of red, green, cream, white or pink. This model also contains a butter compartment in addition to door shelves. The respective prices, including purchase tax, of the new models are £70 7s (MZ-45) and £77 14s (DZ-45).

Lightfoot model LH.26 9·2 cu ft refrigerator



Frigidaire MZ-45 4·4 cu ft refrigerator

GENERATION and DEVELOPMENT

Ulster Atomic Power Station

In the Northern Ireland House of Commons last week the Minister of Commerce (Lord Glentoran) said that he had decided, for the present, to forgo the advantage of having the proposed atomic power station in the western Lough Neagh area. He and the Minister of Health were concerned that a site should be selected which not only fulfilled safety conditions, but which, among those available, most easily passed any safety tests that could be applied. For that reason a coastal site would be preferable to an inland one.

Lord Glentoran said he was advised that, despite the loss of the Lough Neagh area advantage, an atomic power station would still be the best development, economically, of the Northern Ireland supply system by about the date they had in mind—1963 or 1964. Investigation had been started on the suitability of a coastal site to fulfil the required conditions and from which discharges could be to the open sea instead of enclosed waters. They were proceeding with a programme of development which included the construction of both nuclear and pumped storage power plants in the period 1963-67.

New Glasgow Grid Substation

The South of Scotland Electricity Board proposes to establish a new grid substation at Partick, Glasgow, to be fed by cable from the Windyhill-Braehead 132 kV grid line and to be equipped with two 60 MVA, 132/33 kV transformers. The transformer capacity in the existing distribution substations at Kelvinside, Partick, Byres Road and Old Dumbarton Road will be increased. The work involved, which is estimated to cost £695,000, will be completed during 1962.

London Consultative Council Topics

Hire-purchase terms, facilities for the payment of accounts and the notification of consumers when change-over work is to be carried out were the main items discussed at last Friday's meeting of the London Electricity Consultative Council held at County Hall.

In response to a request by the Council, the Board submitted a list of the terms now available on hire-purchase transactions, the secretary to the Board (Mr. S. Morton Gore) pointing out that this was subject to some minor adjustments. For cookers, kettles (supplied with cookers), storage and immersion water heaters and washboilers the requirements were a deposit of 5 per cent and repayment over a period of up to five years; for refrigerators, washing machines, spin dryers, tumbler dryers, drying cabinets, ironing machines and kettles (sold separately), 10 per cent deposit and repayment over three years; and for vacuum cleaners, floor polishers and food mixers, 10 per cent deposit and repayment over two years.

The absence of space heaters from the list was queried in view of the present clean air campaign, and it was also noted that the terms for refrigerators were less favourable than for cookers and water heaters.

The chairman (Alderman I. J. Hayward, LL.D., J.P.) said it was an interesting point that cash sales of appliances had gone up even more than hire-purchase and he believed this had also happened in the gas industry.

It was reported that, as from 1st January, consumers in the North Western District who opened an account at the Hampstead, Harlesden, Kilburn or Hendon branches of the London Trustee Savings Bank could pay their electricity accounts through the Bank. This would be a completely free service. If successful, the scheme might be extended to other parts of the Area.

On the question of the change-over of consumers' apparatus, it was thought that it would be of assistance to consumers planning their purchases of equipment if they were informed when this work was contemplated. The secretary intimated that this problem was now being studied by the Board and he hoped to make a statement at the next meeting.

Shepherds Bush Service Centre

The recently opened Service Centre of the London Electricity Board at Shepherds Bush (briefly referred to in last week's issue, page 1096) will eventually form part of a new building which is being erected to house the whole staff of the Western District. It is hoped that the whole programme, including a demonstration theatre which will form an extension to the present centre, will be completed by the end of 1959.

The new showrooms at present occupy a floor area of 1,850 sq ft and "Tyrad" underfloor heating has been installed throughout. A strip of pavement, 2½ft wide, running the full length of the 33ft frontage has been similarly heated beneath the paving stones. The loading is about 10 W/sq ft and it is hoped that it will prevent frost and snow remaining during cold weather.

The showroom interior contains a wide range of domestic electrical equipment items and additional display space is provided by mirror-backed illuminated showcases around the walls.

The decoration is very tasteful, one wall being panelled with tongued and grooved pinewood in natural finish, and the others in light pastel shades. A special feature of the ceiling is a wooden structure suspended some 2½ft below. This is composed of slatted wood lengths, spaced 9in apart, and covers two-thirds of the total area. General lighting is provided by fluorescent lamps but other ceiling space is made available for displays of lighting fitting clusters. The installation provides a high standard of illumination entirely without glare.

Underground Railway Automatic Signalling

The third and final stage in the conversion to completely automatic signalling of junctions on the in-town sections of London Transport's Northern Line was brought into use at Euston on 16th November. The signalling of trains at Euston is now carried out by programme machines similar to those at Kennington and Camden Town. Between them, the three programme machines carry out automatically all junction signalling operations required to work the 1,200 trains a day on the central section of the Northern Line.

Caravan Showroom

To bring the latest electrical equipment to the notice of people in the most remote parts of its area, the North of Scotland Hydro-Electric Board is using a caravan showroom. This two-wheeled shop, towed by a "Landrover," carries a cable which

The North of Scotland Hydro-Electric Board's caravan showroom pays a visit to Port Vasgo, on the north coast of Sutherland

enables power supply to be obtained from the mains so that the appliances may be demonstrated. Equipment normally carried includes five cookers, two refrigerators, two washing machines, a wash boiler, a spin dryer, and many small appliances. The caravan has fluorescent and other lighting fittings.

Speeding-up Rural Electrification

It was announced last week by the South Western Electricity Board that a further capital allocation had been authorised to meet the special difficulties in the West Country. These included the urgent need to strengthen the existing network and at the same time to extend supplies to new consumers in a mainly rural area. A spokesman said that the Board was likely to connect over 1,000 farms in the financial year ending next March instead of the 850 planned when the capital investment restrictions were imposed. In addition, about 5,300 more cottages and other rural properties would be supplied (against 4,700). This meant that the previous rate of progress in rural development would be partly restored, and next year the Board looked forward to bringing the rate up to what it had been before the restrictions made it necessary for a number of schemes to be deferred.

Electronic Control in Agriculture

On the electricity stand at the Royal Highland Show in Dundee last year the North of Scotland Hydro-Electric Board in conjunction with the Electrical Development Association and Henry Simon, Ltd., showed a "Farmer's Den of the Future," in which was featured an industrial type electronic machine for proportioning feeding stuffs. The machine demonstrated the principle of press-button preparation of livestock rations, each ration containing ingredients in their correct proportions. Most visitors considered the machine as something very definitely of the future, but at least one farmer, Mr. J. S. Watson, of Muir of Pert Farms, Ltd., near Dundee, with electricity already providing heat and light for his pigs, decided, on seeing the industrial type electronic machine, that electricity would also process their rations. Mr. Watson is now using a large electrically powered milling and mixing plant incorporating bulk storage bins for processed and unprocessed ingredients. The electrically driven metering devices require hand-setting when the proportions are changed to suit varying rations, otherwise the plant is completely automatic. The equipment is driven by seven electric motors totalling 25 h.p. A saving of approximately £4 per ton of feed has resulted from the installation of the unit.

East Midlands Tariffs

In answer to a question on the future trend of retail tariffs, Mr. J. Mould, chairman of the East Midlands Electricity Board, informed members of the Electricity Consultative Council on 3rd December that he would be very disappointed if the general level of tariffs had to be raised during the next financial year. There would, however, be some adjustments to the industrial and certain commercial tariffs which would alter the amounts paid by individual consumers in these categories, but these adjustments would not bring in any additional revenue to the Board. Mr. Mould added that, provided there were no large increases either in coal prices or in the cost of materials and labour, it might even be possible to maintain the present level of tariffs during the following financial year.

Overhead Lines in Villages

Consideration was given at last week's meeting of the East Midlands Electricity Consultative Council to the observations of the Area Board on the views the Council had expressed on the erection of overhead lines in villages, particularly where new groups of houses or small estates in rural areas were concerned. The Board indicated that it fully appreciated the problems associated with the appearance of overhead lines but pointed out that it was in no position to undertake the extra expenditure which would be involved in laying underground cables, as rural supplies as a whole could not be considered as economic. Even if an individual scheme showed a better return, there was still a paramount need to economise as far as possible in the capital spent on it so as to help rural development generally to become more self-supporting.

OVERSEAS

South African Commission's Report

In our issue of 26th September we published a brief review of the 1957 operations of the Electricity Supply Commission of South Africa. The full report of the Commission has now been received and the accompanying table gives some further details of revenue, production and sales. At the end of 1957 a total of 2,894 MW of plant was installed in the Commission's power stations. Plant on order included generators with a total rating of 920 MW and boilers aggregating 8,110,000 lb/hr. During the year the Taaibos power station (Rand and Orange Free State Undertaking) was completed and, with a capacity of 480 MW, is at present the largest power station in the Union. New developments, however, include a power station with a capacity of 500 MW in Natal. Borrowing powers amounting to £7 million have been granted for the first stage of this station (Ingagane) which will have 100 MW sets. Two sets of this size have already been ordered for the Komati power station in the Eastern Transvaal and are planned for commissioning in 1961. The two 900,000 lb/hr boilers will be designed to operate at 1,250 p.s.i., 950 deg F.

	1957	1956
Total revenue, £ million ...	28·6	25·8
Total production costs (including interest, redemption and reserve fund charges), £ million ...	28·8	26·4
Difference between revenue and production costs ...	−£188,773	+£643,900
Average price per kWh sold	0·537d	0·514d
Average revenue per kWh sold (including sundry revenue)	0·538d	0·515d
Average cost per kWh sold	0·542d	0·528d
kWh generated, millions ...	14,639	13,578
kWh sent out, millions ...	13,640	12,670
kWh purchased, millions ...	163	257
kWh sold, millions	12,763	12,019
Capital expenditure, £ million	£17·6	£18·9

Large N.S.W. Steam Station

At Wallerawang, a high valley of the Great Dividing Range, 100 miles from Sydney, the Electricity Commission of New South Wales is building a large power station. About £5 million has been spent in six years on the station to produce, initially, 60 MW of power for the Commission's network. Another £19 million will be spent before the station is completed in 1962 with a capacity of 240 MW. The station and its installations are set in 65 acres of ground on the west side of Cox's River. The main power station building is 400ft long and 260ft wide, the maximum height of the walls being 135ft. More than 1,000 men are employed on the project. The site is 2,835ft above sea level. John Thompson (Aust.), Pty., Ltd., is supplying the six pulverised fuel boilers, worth £8,100,000; Australian Electrical Industries Pty., Ltd., is installing four generators and electrical equipment for £3,770,000; and two other generators are being supplied by the British General Electric Co. Pty., Ltd., for £2,300,000.

Electricity Control in Ceylon

The Minister of Transport of Ceylon, Mr. Senanayake, is being urged by various public bodies to implement the report of Mr. J. C. Park, the British electricity consultant, on the reorganisation of the island's electricity supply industry. The Minister has expressed the view that the conclusions and recommendations in the report are valid and should be implemented in full in the national interest. The report recommended the transfer of the industry to public control.

Bangkok Distribution Extensions

Tenders are expected to be issued about the end of the year for a distribution system, estimated to cost $U.S.25 million, to supply to Bangkok the 140 MW of power which will be available when the Yan Hee project is completed.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

2855. Ericsson Telephones, Ltd., and Acton, J. R.—Electronic means for counting electrical impulses. 4th April, 1955. (806002.)

10566. Thorn Electrical Industries, Ltd.—Cathodes for electric discharge devices. 30th March, 1955. (806112.)

11239. Postmaster General.—Electrical insulators for indirectly heated cathodes of thermionic valves. 9th May, 1955. (806003.)

29647. Green & Son, Ltd., E.—Heat exchangers. 21st September, 1955. (806049.)

1955

4537. Postmaster General.—Apparatus for laying submarine cable. 15th May, 1956. (806123.)

5734. General Electric Co., Ltd.—Electric lighting arrangements for indoor illumination. 24th May, 1956. (806124.)

6319. Landis & Gyr A.G.—Supervisory arrangement utilising a rectifying impedance as sensing means. 3rd March, 1955. (806091.)

6605. Igranic Electric, Ltd.—Regulating apparatus. 7th March, 1955. (805919.)

9841. Thorn Electrical Industries, Ltd.—Electric lighting fittings. 14th March, 1956. (805833.)

10236/7. British Tabulating Machine Co., Ltd.—Electronic control circuits employing multi-cathode gas-filled tubes. 7th April, 1955. (806041/2.)

10747. Sylvania Electric Products, Inc.—Electromagnetic coils. 14th April, 1955. (806164.)

11279. General Electric Co., Ltd.—Electric hotplates. 19th April, 1956. (806165.)

16968. British Thomson-Houston Co., Ltd.—Motion limiting means for travelling cranes. 8th June, 1956. (805973.)

19735. General Electric Co., Ltd., and Walsh, A. S.—Waveguide arrangements including windows for passing electromagnetic waves. 5th July, 1956. (805920.)

23200. Engelhard Industries, Inc.—Electric lamps. 11th August, 1955. (805935.)

24390. Carr Fastener Co., Ltd.—Holders for thermionic valves, electrical plugs or other electrical devices having projecting terminal prongs. 20th August, 1956. (805936.)

25575. General Electric Co., Ltd.—Production of semi-conductor bodies. 9th August, 1956. (806168.)

25744. Patchold Patentverwertungs- & Elektro-Holding A.G.—Process for the production of a hot cathode for thermionic tubes. 8th September, 1955. (806032.)

26433. Preformed Line Products Co.—Helically-preformed reinforcements for linear bodies such as wires or cables. 15th September, 1955. (805872.)

26441. Patent-Treuhand-Gesellschaft für Elektrische Glühlampen.—Electronic flash tubes and circuits therefor. 15th September, 1955. (805937.)

26607. General Electric Co.—Electric lamps and like devices. 16th September, 1955. (805881.)

26609. General Electric Co.—Method of and apparatus for making supports for wire coils. 16th September, 1955. (805882.)

28407. British Insulated Callender's Cables, Ltd.—Fuses particularly for electric capacitors. 5th October, 1956. (806117.)

29097. Etablissements E. Jaeger.—Thermally compensated magnetic apparatus. 12th October, 1955. (805894.)

31669. Decca Record Co., Ltd.—Radar apparatus. 17th May, 1956. (805977.)

32685. General Electric Co., Ltd.—Electric plug and socket couplings. 8th November, 1956. (806118.)

33065. Standard Telephones & Cables, Ltd.—Electrolytic capacitor. 18th November, 1955. (805856.)

33838. Philips Electrical Industries, Ltd.—Methods and apparatus for reproducing sound. 25th November, 1955. (806169.)

34481. Sylvania Electric Products, Inc.—Apparatus for exhausting electric discharge devices. 1st December, 1955. (805896.)

34623. General Electric Co., Ltd.—Control systems for electric motors. 29th November, 1956. (806034.)

34683. T.I. (Group Services), Ltd.—Method of heating material in an electric furnace. 5th February, 1957. (806035.)

35305. Carr Fastener Co., Ltd.—Holders for electric lamp bulbs, electronic valves and the like. 3rd December, 1956. (805840.)

35441. General Electric Co.—Circuits for electric discharge lamps. 9th December, 1955. (805924.)

37449. Compagnie Française Thomson-Houston.—Measurement of magnetic fields. 30th December, 1955. (805926.)

1956

223. Lodge-Cottrell, Ltd.—Electrostatic precipitators and the like. 7th February, 1957. (806126.)

356. Carr Fastener Co., Ltd.—Holders for electric lamps. 14th December, 1956. (805943.)

512. Babcock & Wilcox, Ltd.—Method of operating nuclear power plant and improvements in such plant. 4th January, 1957. (806068.)

792. Federated Foundries, Ltd.—Electromagnetic motors. 14th December, 1956. (806021.)

6011. Siemens Edison Swan, Ltd.—Automatic telephone exchanges and like selective systems. 6th February, 1957. (806069.)

6350. British Insulated Callender's Cables, Ltd.—Manufacture of joints and termination of electric cables. 27th February, 1957. (806070.)

6528. M-O Valve Co., Ltd., and Dutt, T. L.—Electric discharge devices having a gas filling and containing in addition water vapour. 28th May, 1957. (805944.)

6644. Foster Wheeler, Ltd.—Protective device for heat exchangers. 19th February, 1957. (806036.)

6960. Officine Meccaniche Riunite S.p.a.—Controllers for electric circuits. 6th March, 1956. (806037.)

10693. Automatic Telephone & Electric Co., Ltd.—Telephone systems. 8th March, 1957. (805946.)

11367. General Electric Co., Ltd.—Electric switch boxes. 10th April, 1957. (806129.)

13040. Sylvania Electric Products, Inc.—Photoflash lamps. 27th April, 1956. (806101.)

15000. Hoffmann, H. A.—Electric cables. 14th May, 1956. (806013.)

15111. Hollins, J. R.—Two-part electrical connector. 15th May, 1956. (805948.)

19429. General Electric Co.—Dynamo-electric machines. 22nd June, 1956. (805927.)

19445. Brown, Boveri & Cie. A.G.—High current contact convertor plants. 22nd June, 1956. (805901.)

19725. Mallory & Co., Inc., P. R.—Snap-action electric switches. 26th June, 1956. (806015.)

21879. Williams, D. R., and Williams, C. D.—Time switches. 21st June, 1957. (805845.)

26001. Mallory-Sharon Metals Corporation.—Consumable electrode arc furnace construction and operation. 24th August, 1956. (806157.)

27765. British Thomson-Houston Co., Ltd.—Supporting steam condensers of turbine power plants. 30th July, 1957. (806131.)

28596. Electric & Musical Industries, Ltd.—Magnetrons. 18th June, 1957. (805955.)

30791. United-Carr Fastener Corporation.—Holders for electric lamp bulbs. 9th October, 1956. (805875.)

31193. Siemens Edison Swan, Ltd.—Electronic tone generators. 26th September, 1957. (805849.)

31979. Parker, L. W.—Electrical moving coil instruments. 19th October, 1956. (806039.)

32763. Hoover, Ltd.—Suction cleaners. 26th October, 1956. (806084.)

33743. Siemens & Halske A.G.—Arrangements for returning the carriage of a motor-driven printing machine, for example a teleprinter, to the beginning of a line. 5th November, 1956. (806133.)

34307. Soc. Française Radio-Electrique.—Directional radio apparatus. 9th November, 1956. (805910.)

34311. Western Electric Co., Inc.—Adjustable inductance device. 9th November, 1956. (805930.)

37710. Compagnie Industrielle des Telephones.—Electromagnetic selecting devices. 10th December, 1956. (806028.)

37870. Henley's Telegraph Works Co., Ltd., W. T., and Moor, E.—Terminating glands for armoured electric cables. 11th December, 1956. (805850.)

38289. Standard Telephones & Cables, Ltd.—Electric signalling circuits. 14th December, 1956. (806086.) 39002. Multi-channel signal system. 21st December, 1956. (806087.)

1957

165. Ateliers de Constructions Electriques de Charleroi.—Electric remote control positioning system. 2nd January, 1957. (Addition to 758765.) (805914.)

1849. Telefonaktiebolaget L. M. Ericsson.—Apparatus for reading the number of electrical impulses registered in a magnetic registering device. 17th January, 1957. (805984.)

2160. Proctor Electric Co.—Adjustable thermostatic control mechanisms for electric bread toasters. 21st January, 1957. (805866.)

4041. National Cash Register Co.—Magnetic core switching circuit. 6th February, 1957. (806076.)

5736. Mullard, Ltd.—Electrical simulators. 20th February, 1957. (805988.)

6889. Marconi's Wireless Telegraph Co., Ltd.—Stabilised low frequency oscillators. 1st March, 1957. (806078.)

10790. Lenning, A.—Electrically operated oscillatory compressors. 2nd April, 1957. (805992.)

12558. Landis & Gyr A.G.—Maximum demand metering mechanism more especially for electricity meters. 17th April, 1957. (806136.)

14937. Foster Wheeler, Ltd.—Closure for pressure vessels. 10th May, 1957. (806138.)

15224. Allmänna Svenska Elektriska A.B.—Cooling for turbo-generators. 14th May, 1957. (805878.)

16381. Telefunken G.m.b.H.—Submarine camera equipment. 23rd May, 1957. (805994.)

22158. Standard Telephones & Cables, Ltd.—Circuits for generating harmonic frequency spectrums. 12th July, 1957. (806080.)

30416. Hoover, Ltd.—Suction cleaners. 27th September, 1957. (Addition to 767647.) (805890.)

Bulgarian TV Station

A contract to equip the first official television station in Bulgaria has been awarded to Pye, Ltd. It includes studio, telecine and transmission equipment and a mobile unit. The station will serve the capital, Sofia, and is expected to start operating early next year.

Cubicle Switchboards

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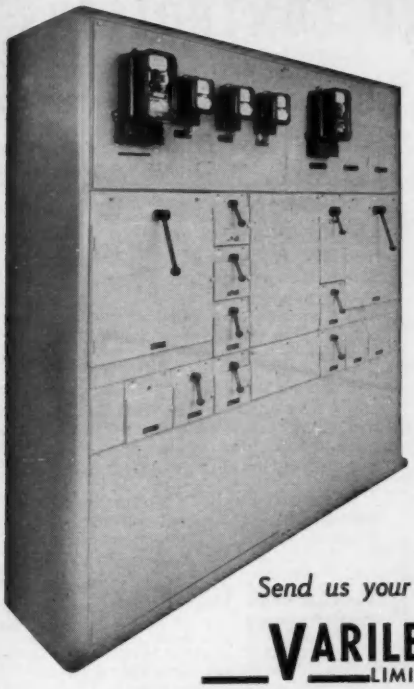

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enables use in temperatures up to 40°C. All transformers and chokes are vacuum impregnated and metal parts heavily plated. All wiring is PVC insulated.

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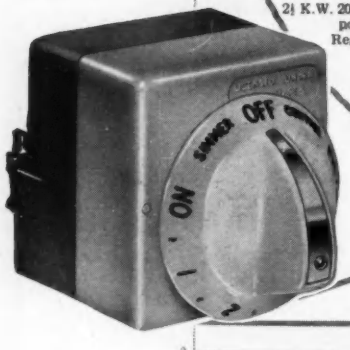

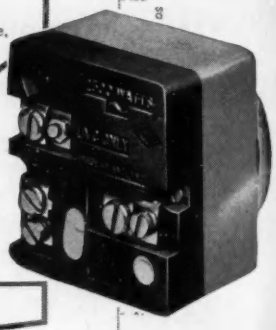

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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Postmaster-General's Department, Melbourne. 19th February. Radio telephone systems and associated equipment. (E.S.B. 30225/58. Ten/36193.)*

Burma.—Police Supply Department, Rangoon. 26th January. Traffic control equipment. (E.S.B. 30339/58. Ten/36228.)*

France.—Supreme Headquarters, Allied Powers Europe, Paris. 31st December. Fluorescent and incandescent lamps. (E.S.B. 30481/58. Ten/36233.)*

Iran.—Iranian State Railway, Teheran. 20th January. Electric switches and plates with accessories. (E.S.B. 30262/58. Ten/36224.)*

Iranian Tobacco Monopoly, Teheran. 29th January. Electric motors and pumps. (E.S.B. 30475/58. Ten/36250.)*

Plan Organisation, Teheran. 31st January. Electrical installations for town of Kaltchai. (E.S.B. 30215/58. Ten/36206.)*

Kuwait.—Department of Electricity. Two 320,000 lb/hr water tube boiler units. (E.S.B. 30441/58. Ten/36248.)*

New Zealand.—King County Electric Power Board, Taumarunui. 10th March. Main plant for Kuratau hydro-electric development. (E.S.B. 30213/58. Ten/36204.)*

Norwich.—Corporation. 3rd January. Street lighting equipment. (See this issue.)

Pakistan.—Department of Supply and Development, Karachi. 6th January. Electrical apparatus, scientific instruments and air conditioning units. (E.S.B. 29957/58/I.C.A. Ten/36169.)* 27th January. Electric lighting equipment. (E.S.B. 29960/58/I.C.A. Ten/36170.)*

Posts and Telegraphs Department, Karachi. 27th December. Alarm fuses. (E.S.B. 30405/58. Ten/36243.)*

Penge.—U.D.C. 8th January. Street lighting equipment. (See this issue.)

Rhodesia and Nyasaland.—Umtali Municipality. 7th January. L.v. cable. (E.S.B. 30102/58. Ten/36182.)* Distribution transformers. (E.S.B. 30101/58. Ten/36164.)*

South Africa.—Durban City Council. 30th January. Telephone cable. (E.S.B. 30003/58. Ten/36160.)*

Sudan.—Sudan Light & Power Co., Ltd., Khartoum. 31st January. One 10,000 kVA, one 5,000 kVA and two 2,500 kVA transformers. (E.S.B. 30470/58. Ten/36249.)*

Swansea.—Corporation. Electrical installation at Trallwn County Primary School. (See this issue.)

Thailand.—Thai Technical and Economic Committee, Bangkok. 2nd January. Electrical apparatus, including outdoor circuit-breakers, switchgear, switchboard, station battery and battery charger. (E.S.B. 30098/58/I.C.A. Ten/36252.)*

ORDERS PLACED

Durham.—County Education Committee. Electrical installations, Ryton County Infants' School (£1,234), and Spennymoor West Modern School (£6,291).—Eastern and Home Counties Electrical Contractors.

Stratford-on-Avon.—Corporation. Recommended. Lighting of the Winchester/Preston and Lincoln/Bath trunk roads (£4,431).—G.E.C.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Ascot.—Out-patients', casualty and X-ray departments at Hatherwood Hospital Regional Hospital Board; regional architect, Sheffield House, Sheffield Street, London, W.C.2.

Barking. — Four nine-storey blocks of maisonnettes; E. R. Farr, town clerk, Town Hall.

Barnes.—Flats (40) in Railway Street; W. R. Shepherd, borough engineer, Municipal Offices, Sheen Lane, S.W.14.

Basildon.—Lee Chapel South County Primary School (£85,000); H. Conolly, Essex county architect, County Hall, Chelmsford.

Bedford.—Two-storey administrative wing at Mander College, Cauldwell Street; county architect, Shire Hall, Bedford.

Flats (48), Queen's Drive, Putnoe; borough surveyor.

Six-storey block of municipal offices (£230,000); F. W. Dawkes, borough engineer, Newnham House, Horne Lane.

Berkhamsted. — Factory and offices; Chrysaline, Ltd., 282, High Street.

Berwick.—Houses (36), Spittal Hall estate; J. H. Pierce, builder, Tweedmouth.

Billingham-on-Tees.—Houses (38), Roseberry Road; surveyor.

Birkenhead.—Factory, Bridge Street; Moorhouse Bros., Ltd., 55, Everton Road, Liverpool.

Works, Russell Street; K.W.K. (Birkenhead), Ltd., 21, Park Street.

Birmingham.—Six-storey teaching block for College of Technology and Commerce, and library and 26 three-storey flats, Tower Hill, Great Barr; city architect, City Centre.

Blaby.—Council chamber and additional office accommodation at Narborough (£55,000); surveyor, Council Offices, Narborough, Leicester.

Blackburn.—Flats (161), Lincoln Street; borough engineer.

Blackwell.—Houses (106), South Normanton; housing superintendent, Chesterfield Road South, Mansfield.

Brentford.—Office block, Kew Bridge; Pascall & Watson, architects, 24, Half Moon Street, London, W.1.

Bristol.—Works extension for Baker, Dearden & Co., Ltd., York Road; Bray & Slaughter, Ltd., Parson Street.

Two blocks of halls of residence, Churchill Hall, Stoke Park Road (£175,000), for University Authorities; Oatley & Brentnall, architects, 12, Great George Street, Bristol, 1.

Brockenhurst.—Extensions to County High School; Pinckney & Gott, architects, 7, Gray's Inn Square, London, W.C.1.

Cannock.—Houses and bungalows (94); Eadie & Co., Ltd., builders, 29, Waterloo Road, Wolverhampton.

Cardiff.—Five-storey car park, Wood Street; city surveyor, City Hall.

Dwellings (115), Bishopton Road, Ely; city architect.

Carlisle.—Church, Wigton Road; John Laing & Sons, builders, Dalston Road, Carlisle.

Chadwell Heath.—Showrooms, flats and stores, High Road; Florey & Sons, Ltd., 70, Balfour Road, Ilford.

Cheshunt. — School, Cadmore Lane (£66,070); C. H. Aslin, Herts. county architect, County Hall, Hertford.

Chesterfield.—Houses (90), Dunston Hall estate; W. J. Sims, Sons & Cooke, Ltd., Haydn Road, Sherwood, Nottingham.

Chingford.—New municipal offices; Tooley & Foster, architects to Council, Midland Bank Chambers, Buckhurst Hill, Essex.

Chipping Norton.—Factory, The Leys; Dormer Plastics, Ltd., West Hartlepool.

Conisbrough (Yorks).—Bungalows (50), Denaby Main and Marchgate; surveyor, 5, High Street.

Corringham (Essex).—Secondary School (£150,000); Brown & Moulin, architects, 42, Russell Square, W.C.1.

Cumberland.—Secondary school at Distington; J. H. Haughan, county architect, Portland Square, Carlisle.

Dartford.—Flats, maisonnettes and bungalows (50), Temple Hill neighbourhood unit; borough surveyor, The Bridge House.

Dover.—Houses (107), Buckland and Aycliffe estates; borough engineer.

Dundee.—Denture manufacturing factory; J. Barr & Son, architects, St. Vincent Street, Glasgow.

Durham.—Second instalment of proposed Easington Technical College; Cordingley & McIntyre, architects, Owengate, Durham.

Additions to Hookergate Grammar, Jarrow Central Modern, Jarrow Croft Terrace, and Shotton Modern Schools, for the E.C.; county architect, South Street, Durham.

Houses (16), Sherburn; J. F. Willis, housing architect, Byland Lodge, Durham.

East Barnet.—Dwellings (74), Bevan estate; Carlton Contractors, Ltd., Ashley Road, Epsom.

Exeter.—St. James' Secondary Modern School for Girls, Summer Lane; city architect.

Glasgow.—Flats (428), in multi-storey blocks, Commercial Road area; Basil Spence & Partners, architects to City Council, 47, Moray Place, Edinburgh.

Grantham.—Shops and flats in North Street, Broad Street and Chapel Street area; borough surveyor.

Harlow.—Second stage of West Essex College of Further Education; Thomas Bates & Sons, Ltd., builders, Church Road, Harold Wood, Romford.

Hebburn-on-Tyne.—Flats, Station Road and Glen Street; U.D.C. surveyor.

Hendon.—Extensions for laboratories and offices; British Launderers' Research Association, Hillview Gardens, N.W.4.

Hereford.—Occupational centre for adult mental defectives, Rockfield Road; W. Usher, county architect, Bath Road, Hereford.

High Wycombe.—Houses (500), Hazlemere Park; W. T. Warren, Ltd., South View Road, Gerrards Cross.

Hockley.—Secondary school (£107,000); Gerald Shenstone & Partners, architects, 34, Bloomsbury Way, London, W.C.1.

Hornchurch.—Cranham County Secondary School (£135,000); H. Conolly, county architect, County Hall, Chelmsford.

Hull.—Extensions to Central Library (£147,000); A. Rankine, city architect, Guildhall.

Lancaster.—Special school on site off Morecambe Road (£51,658); Lancs. county architect, County Offices, Preston.

Leeds.—Development of children's unit at St. James's Hospital (£200,000); secretary to Regional Hospital Board, Park Parade, Harrogate.

Leicester.—Extensions to Beaumont Leys School (£101,000); city architect.

Liskeard.—Houses (81), Lake Lane estate; J. H. Snellgrove & Partners, quantity surveyors to Council, 5, Portland Square, Plymouth.

WORK IN PROSPECT (*Continued*)

London.—Flats (132) and maisonnettes (40), Eltham Road, Lewisham; Richard Costain, Ltd., builders, 111, Westminster Bridge Road, S.E.1.

Works extensions, North Acton; Park Royal Products, Ltd., Park Royal Road, N.W.10.

Second stage of development of Lewisham Hospital (£250,000), for South East Metropolitan Regional Hospital Board; architect, 9, Hallam Street, London, W.1.

Office block, Gracechurch Street and Eastcheap, E.C.; W. Curtis Green, Son & Lloyd, architects, 5, Pickering Place, S.W.1.

Office block, High Holborn; Geo. Potton & Sons, Ltd., builders, 46, Gainsford Street, S.E.1.

Factory, Peckham; St. George's Manufacturing Co., Ltd., 44/54, Bridson Street, S.E.15.

Luton.—Houses (254), Lewsey Farm estate; borough architect.

Manchester.—Girls' grammar school, Didsbury; Reynolds & Scott, architects, 9, Albert Square.

Extensions to technical development block; Small & Parkes, Ltd., Hendham Vale Works.

March.—Dwellings (24), North Drive extension; U.D.C. surveyor.

Middlesbrough.—Shopping centre, Crossfell Road; Evans, Cartwright & Woollatt, architects, 4, Clarendon Street, Nottingham.

Rebuilding on site of Grand Electric Cinema, Newport Road, for shops, for Hardy & Co., furnishers; C. Solomon, architect, St. Mary's Place, Newcastle-upon-Tyne.

Houses (48), Low Lane; Premier Dwellings, Ltd., builders, Albert Road, Middlesbrough.

Middlesex.—Fire stations at Feltham, Staines, Stanmore and Sunbury; Middlesex county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Newcastle-on-Tyne.—Block of shops, Kirkwood Drive and Halewood Avenue; Arndale Property Trust, Bradford.

Three-storey industrial building, Blandford Street, for Novo-Enterprises, Ltd.; H. Gatoff, architect, 51, Grainger Street, Newcastle.

Houses (108) and flats (24), Newbiggin Hall estate; J. Twiname, Ltd., builders, Brigham, Cumberland.

Oakengates.—Houses (220); clerk, Stafford Road, Oakengates, Salop.

Okehampton.—Houses (22), Wonnacotts Meadow; George Brown & Partners, architects to T.C., 36-38, Baldwin Street, Bristol, 1.

Peterborough.—Shop and offices, Cowgate; Ruddle & Wilkinson, architects, Long Causeway Chambers.

Four blocks of flats in Oundle Road and six shops and maisonnettes in Hallfields Lane, Paston; city architect, Bridge Street.

Hostel for aged people, Alderman's Drive; architect to Soke of Peterborough County Council, Bridge Street, Peterborough.

Petworth.—Secondary modern school; county architect, County Hall, Chichester.

Pewsey.—Houses (57); surveyor, Rural Council Offices, Pewsey, Wilts.

Port Talbot.—Houses (38), Little Warren; G. V. Griffiths, borough engineer, Municipal Buildings.

Raynes Park.—Extensions to Boys' County School (£79,000); C.A.S. Contractors, Ltd., St. James's Square, W.8.

Rochester.—Dwellings (70), Warren Wood; city surveyor.

Rugby.—Four blocks of flats and maisonnettes (39 dwelling units), Featherbed Lane site; borough engineer, Burford House.

Shepshed.—Additional factory premises; Geo. Braund, Ltd., Factory Street.

Solihull.—Scheme for new Civic Centre (£231,266); C. R. Hutchinson, borough surveyor, 90, Station Road, Solihull, near Birmingham.

Southampton.—Erection of Glen Eyre Girls' Secondary School at Bassett; borough architect.

South Shields.—Infants' school, Highfield (£49,000); R. G. Finlay, Ltd., builders, Ryhope, Sunderland.

Stanley (Co. Durham).—Houses (243), Lintz; J. R. Heslop, U.D.C. surveyor.

Stockton-on-Tees. — Church, Hardwick estate (£30,000); D. F. Smith-Martin, architect, 41, Carlton Hill, London, N.W.8.

Sunderland.—Factory additions, Bonnersfield, for Bergson & Co.; Sloan & Earnshaw, builders, Dundas Street.

Sutton and Cheam.—Civic centre; Milner & Craze, architects, 120, Crawford Street, London, W.1.

Thornbury.—Dwellings (61), Severn View Road, Berkeley; H. W. Tily & Son, Ltd., builders, Wotton-under-Edge.

Wallsend.—Houses (44), Ravensworth Street; J. H. James, builder, Archer Street, Willington Quay.

Walthamstow.—Shopping centre, workshop and estate office, Outwood Common estate; borough engineer, Town Hall.

Whitehaven.—Factory additions for the West Cumberland Silk Mills, Ltd.; Border Engineering Contractors, Ltd., builders, Queen Street, Whitehaven.

Street Lighting Notes

Leeds City Street Lighting Committee recently carried out its annual tour of inspection in the course of which Councillor A. Brown, the chairman, said that the committee was considering the use of more decorative lanterns for such developments as Saxton Gardens where forecourts were to be laid out. Mr. L. A. Doxey, city lighting engineer, said that in the last financial year 80 per cent of the light from street lamps came from 14,000 electric lamps at a cost of £35,000 while the remaining 20 per cent came from 16,400 gas lamps and cost about £61,000.

Chelsea Works and Highways Committee recommends the Council to approve the first stage of the lighting of Class "B" roads, comprising the whole of the areas south of King's Road, east of Sloane Street and north of Pont Street, at an estimated cost of £76,000. It is proposed to use G.E.C. hexagonal post top type lanterns fitted with two 40 W fluorescent tubes and optical gear, with panels glazed in white morocco glass and mounted on tapered octagonal steel columns, the lanterns and columns being painted in an aluminium finish.

Weston-super-Mare Borough Council is applying for loan sanction for converting the street lighting from gas to electricity. The work is estimated to cost £150,000 and is expected to be completed by 1960.

The re-lighting of the "Burning Bush," a lighting standard of wrought iron in a floral design dating from 1864, which stands in the middle of the Slough to Windsor road where it passes through **Eton** College, marks the completion of an A.E.I. Lamp & Lighting Co. street lighting installation covering Eton's main street. The High Street has many old buildings, and considerable effort has been made to keep the installation in harmony with its surroundings. The "Burning Bush," previously gas-lit, now incorporates fluorescent lamps and gear of the type used in the A.E.I. four-lamp post-top lantern. Both the lamps and the auxiliary gear have been housed in the original glazed lantern.

The contract was awarded in 1955 and A.E.I.'s street lighting engineers, working under the direction of Mr. J. W. Smith (engineer and surveyor, Eton) planned a lighting scheme using colour corrected mercury discharge lighting, with fluorescent lighting in the shopping area. Altogether 73 A.E.I. lanterns have been used.

Luton R.D.C. is to seek sanction to borrow the sum of £3,000 for street lighting at Barton, Hockcliffe and Caddington.

Clitheroe Corporation is applying for sanction to borrow £3,244 for the second stage of a street lighting conversion scheme.

Nuneaton Corporation is recommended to approve the preparation of schemes for the improvement of the street lighting in Haunchwood Road, Church Road, Tomkinson Road, and Heath End Road, and in College Street.

New trunk road lighting costing £6,500 will be installed at **Ivybridge,** Devon, next year. The Council has been authorised to accept a tender for the work.

Lowestoft Works Committee proposes to install sodium street lighting in Belvedere Road, Mill Road, Horn Hill and Waveney Drive at an estimated cost of £4,400.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 26th December:—

Challenge. No. 773,610. Class 9. Radio receivers, television receivers and apparatus for recording sound by means of magnetic tape; and condensers, inductances, transformers, accumulators and electronic valves.—Challenge Cycle & Motor Co., Ltd., Lark Hill Road, Worcester.

Mac. No. B776,506. Class 9. Calculating machines; electric and electronic installations for use in the automatic control of industrial operations; measuring apparatus; and parts.—Metropolitan-Vickers Electrical Co., Ltd., St. Paul's Corner, 1-3, St. Paul's Churchyard, London, E.C.4.

No. 777,683 (design). Class 9. Radio receiving apparatus, television receiving apparatus, electrical phonographs, and parts.—Zenith Radio Corporation, Chicago, Ill., U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

BICC. No. 779,192. Class 9. Electric cables, insulated electric wires; electric cable installations, electric wiring systems and electric overhead conductor installations, and parts; and electric capacitors and electricity meters and parts.—British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.

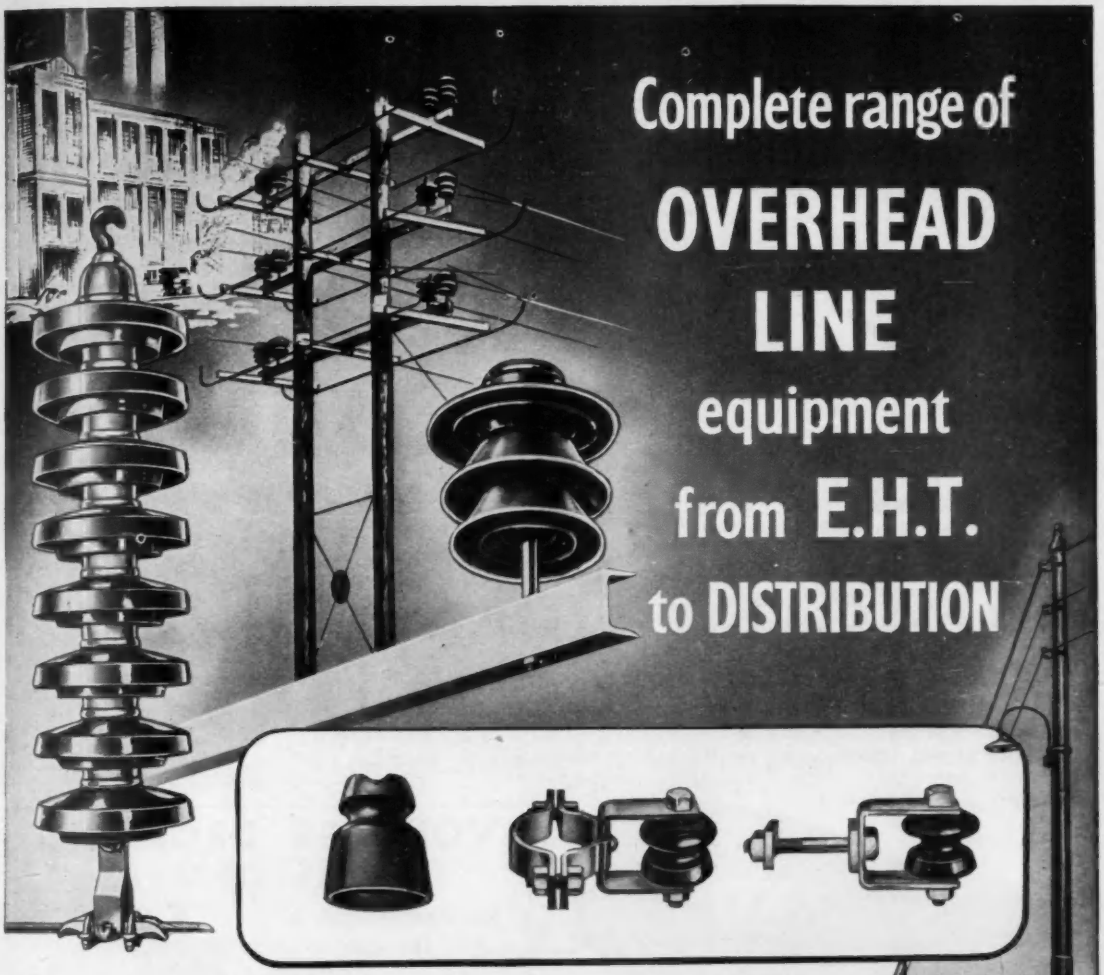
Zodiac. No. 779,687. Class 9. Electric vacuum cleaning apparatus.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

Bunty. No. 779,896. **Romeo.** No. 779,898. Class 9. Television, radio, sound reproducing, sound recording and optical projection instruments and apparatus, and parts, etc.—D. C. Thomson & Co., Ltd., Courier Buildings, Albert Square, Dundee.

Roboreel. No. 779,930. Class 9. Electrical and electronic apparatus for use in automatically controlling the operation of mechanisms used on printing machines for joining or renewing rolls of printing paper on such machines while the machines are in operation; and parts.—Witton-James, Ltd., The Hyde Electrical Works, Edgware Road, Hendon, London, N.W.9.

Falks Summit. No. 776,020. Class 11. Fluorescent lighting installations and parts, but not including paper lampshades.—Falk, Stadelmann & Co., Ltd., Veritas House, 91, Farringdon Road, London, E.C.4.

Adonis. No. 781,066. Class 11. Electric torches.—S. D. Rand, Ltd., 29, Beak Street, Regent Street, London, W.1.



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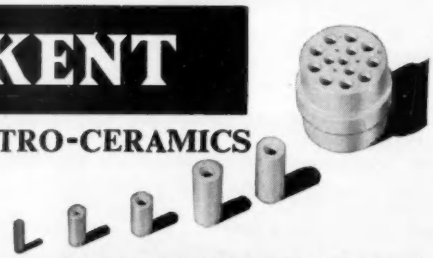

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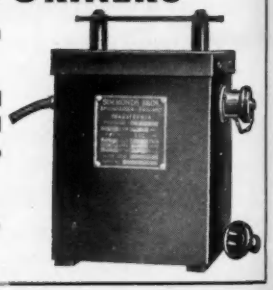

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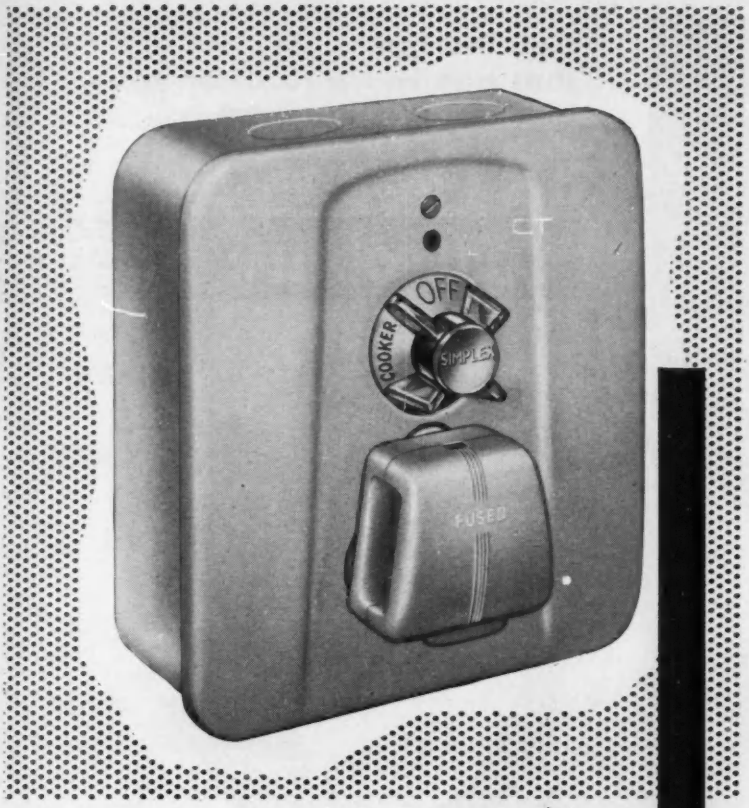

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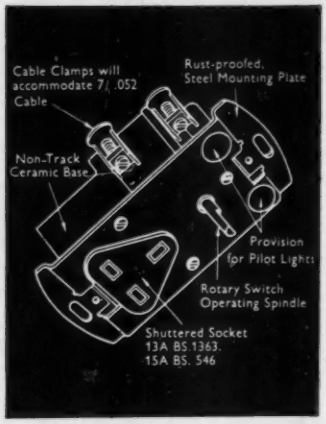
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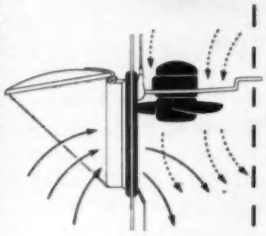
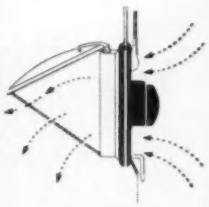
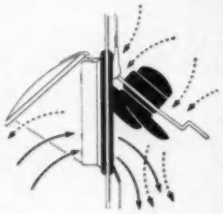


FRESH AIR IN



STALE AIR OUT



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Easy to clean — simply wipe with a damp cloth

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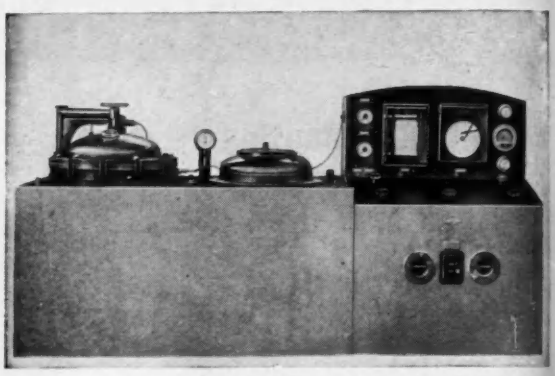

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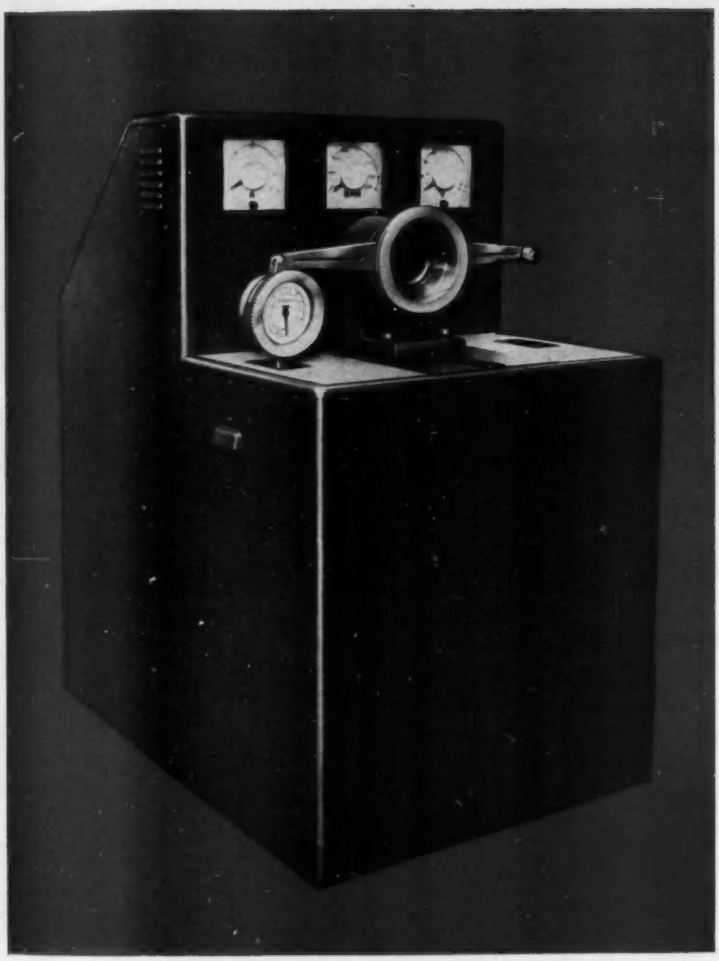

Length	Height	Width
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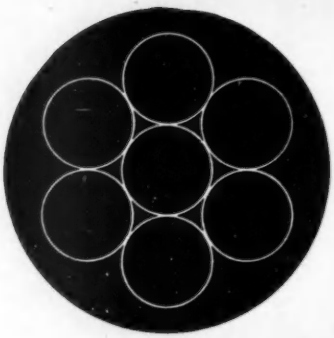
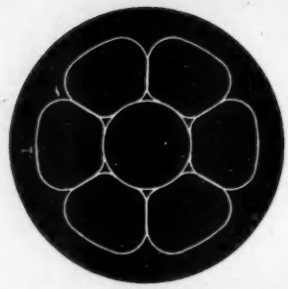


conventionally-stranded conductors



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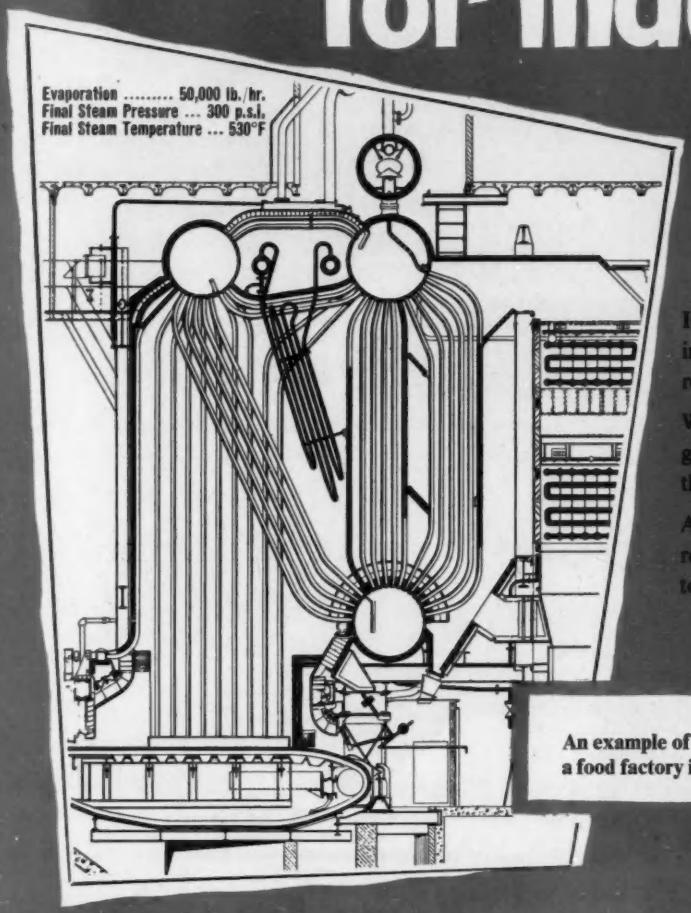

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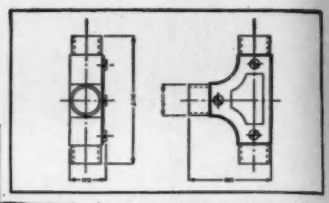

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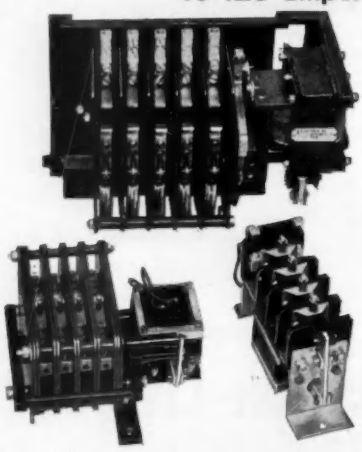

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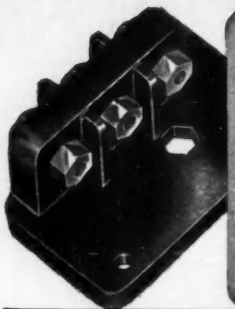

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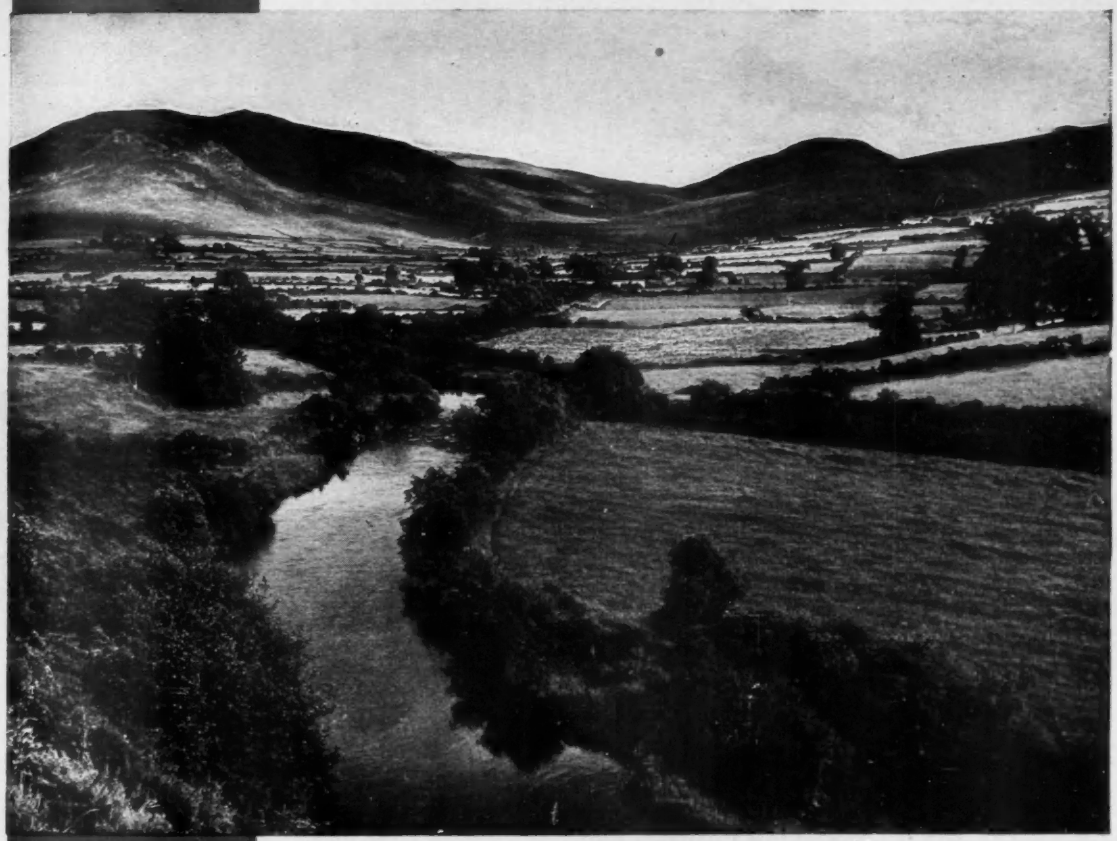
And robes the mountain in its azure hue.
(Pleasures of Hope by Thomas Campbell)



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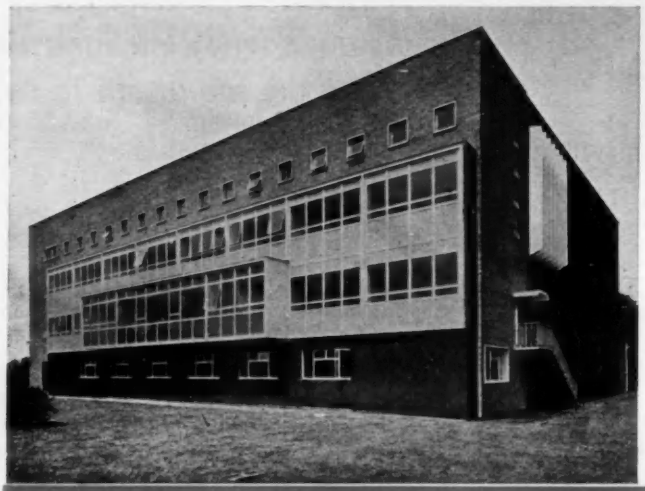
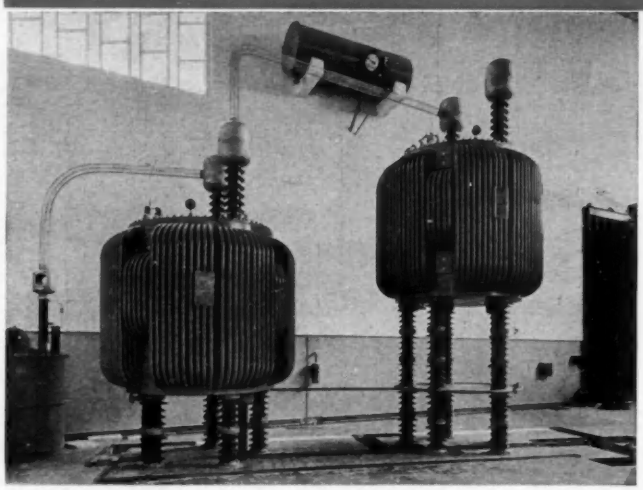


Enfield's new high voltage



Top: The new Laboratory Building.
Above: View of 600 kV, 2.4 MVA, Series resonant transformer/reactor units with feed transformer.
The artist's impression is of the control room overlooking the floor of the H.V. Testing Laboratory.

ENFIELD CABLES LIMITED

Sales Headquarters: Victoria House, Southampton Row, W.C.1. Telephones: HOLborn 9292 (10 lines)

Telex No: 23813 Answer back: ENFIELD LONDON. Telegrams: Enfelcama London Telex.
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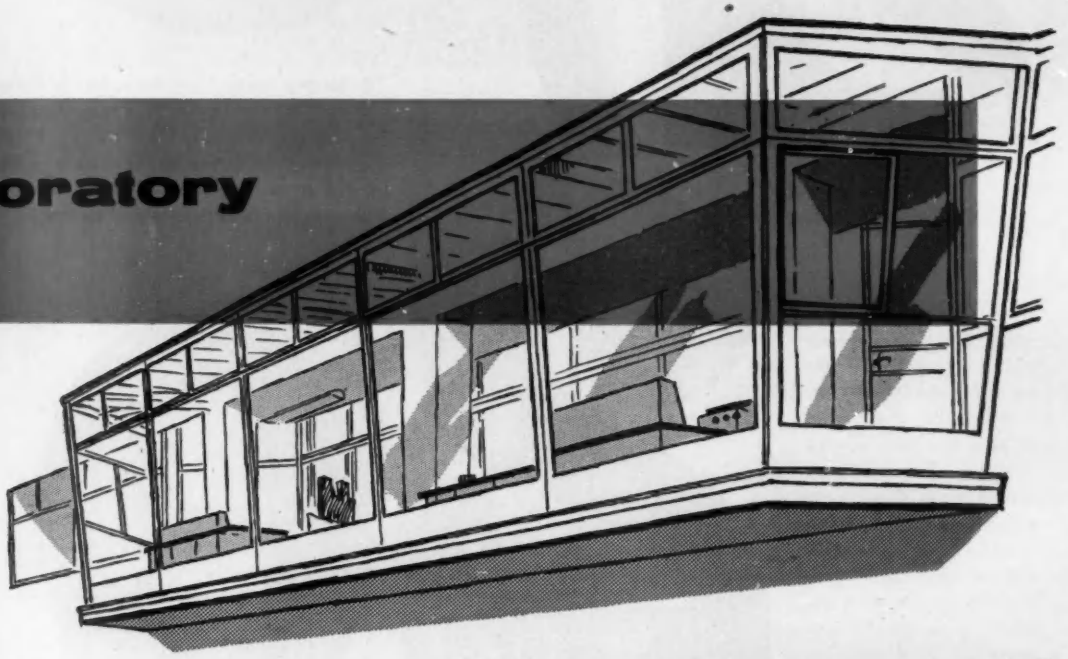

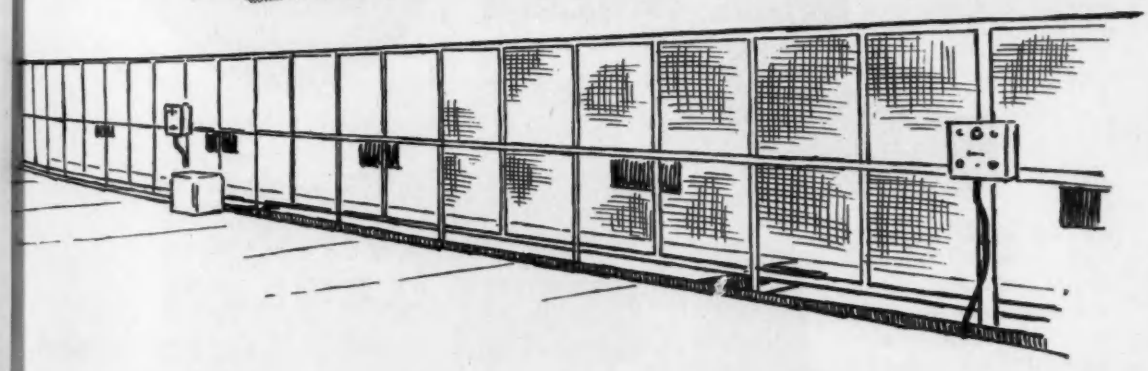

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The only reference you need, to put you in possession of the detailed facts on the entire Mersey wiring cables range is a copy of their new 36 page catalogue No. A/101. Send for one.

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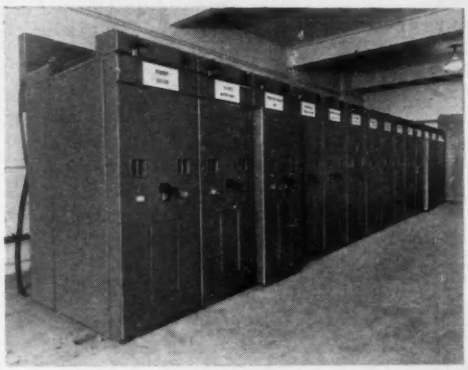
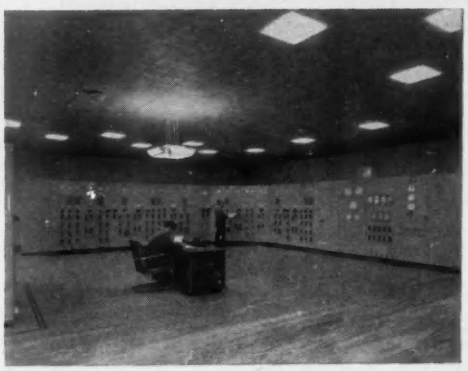
MCW 17





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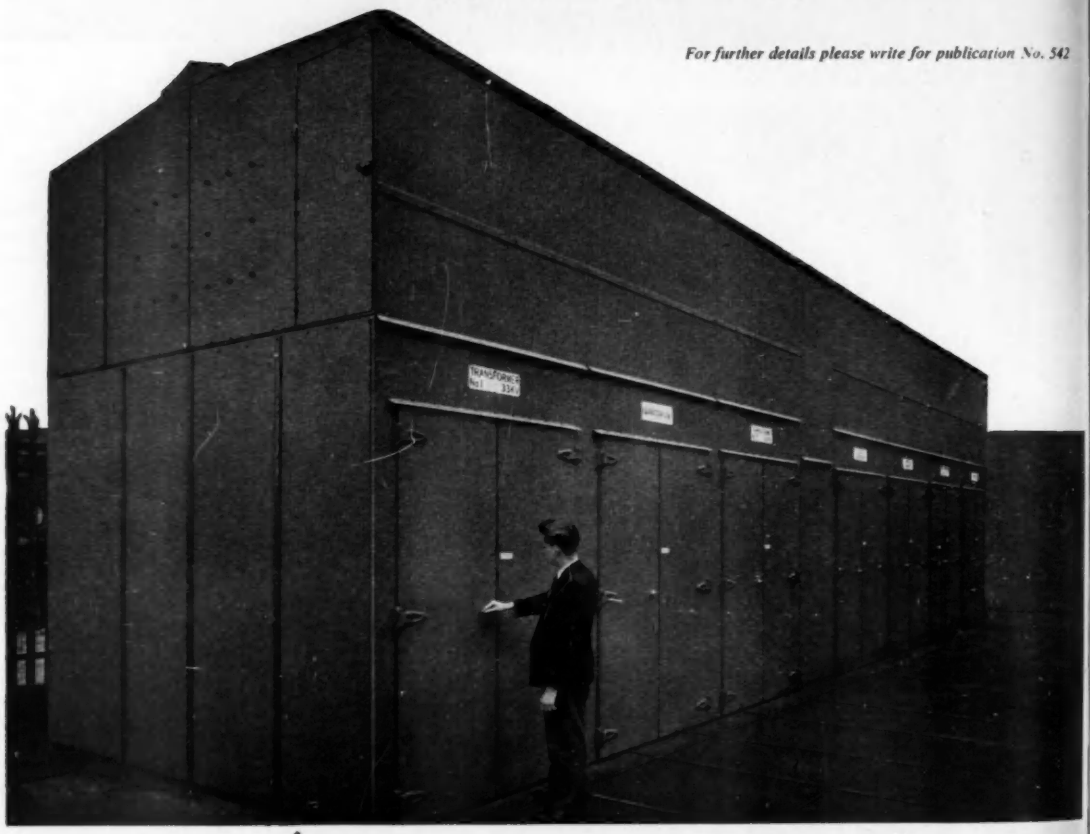

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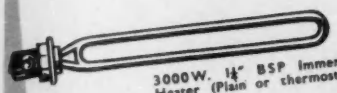

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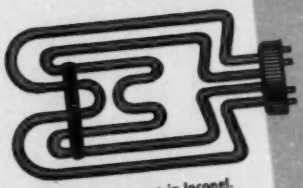

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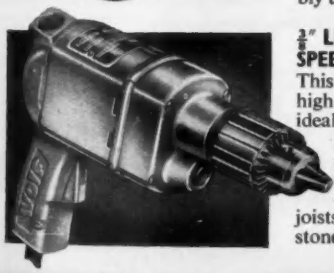

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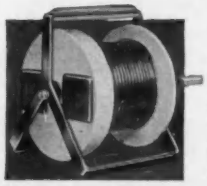

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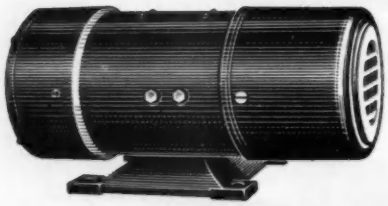

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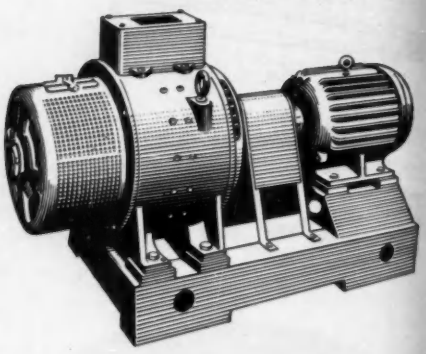

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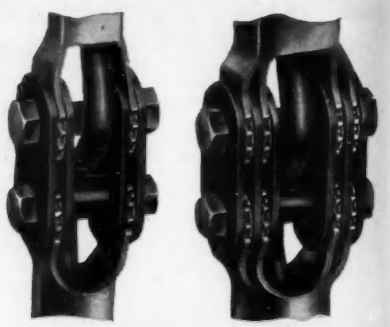

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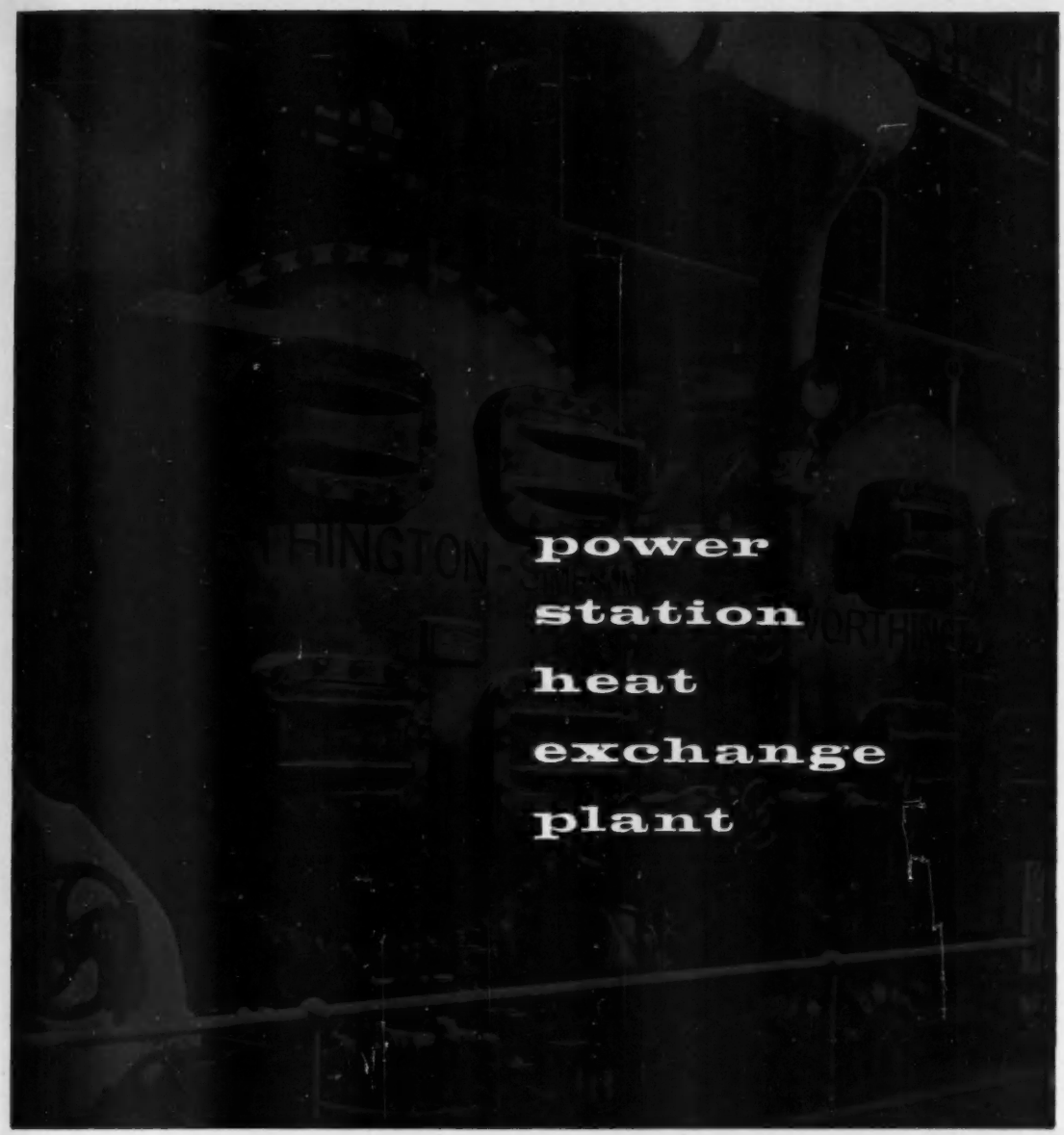

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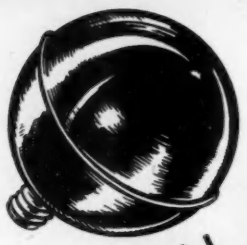

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PUBLIC BLEECO LIGHTING

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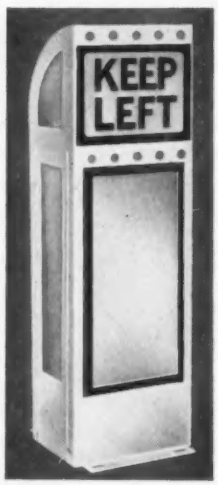

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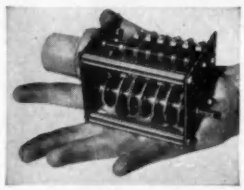

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Every cam continuously adjustable.

Switching capacity 10 amps at 230v AC.

Standard unit can have 1-12 switches.

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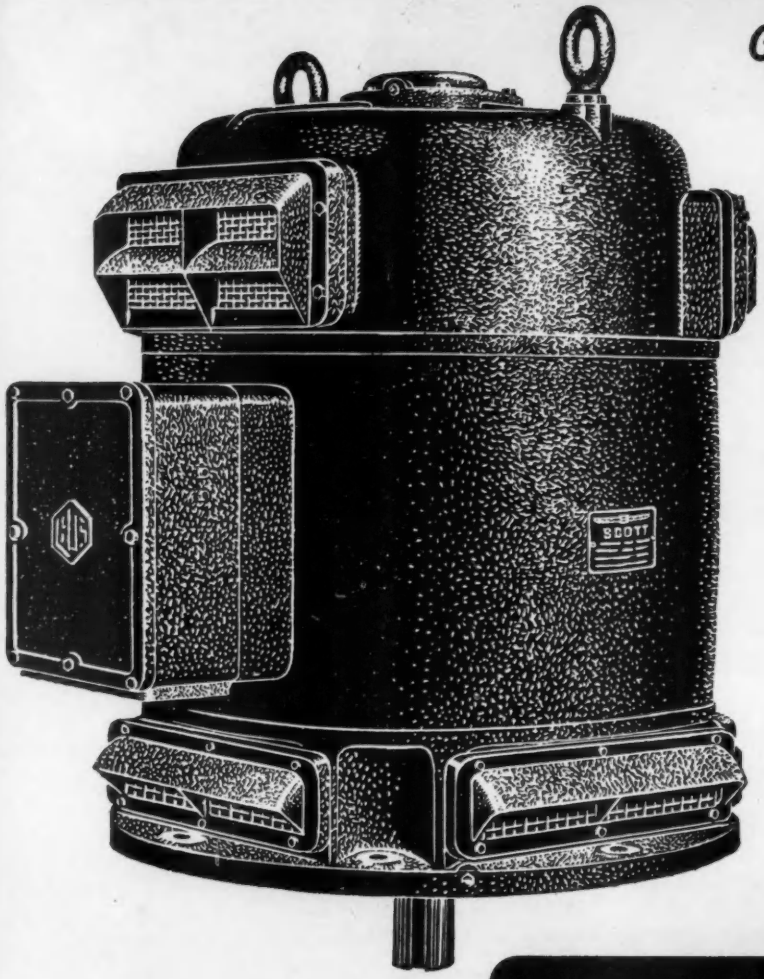

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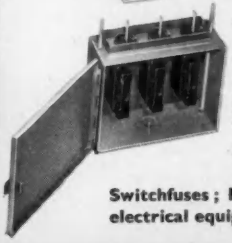

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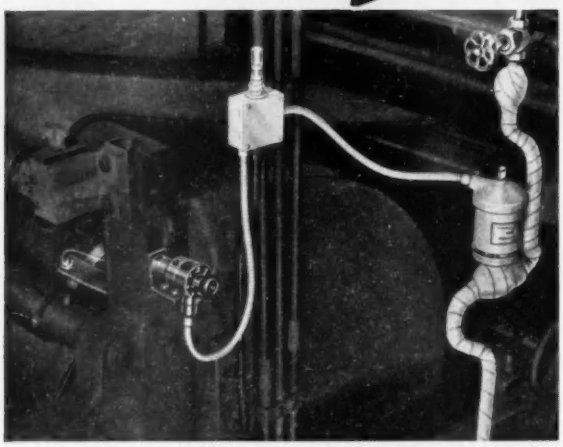

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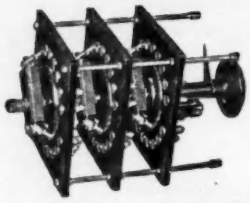

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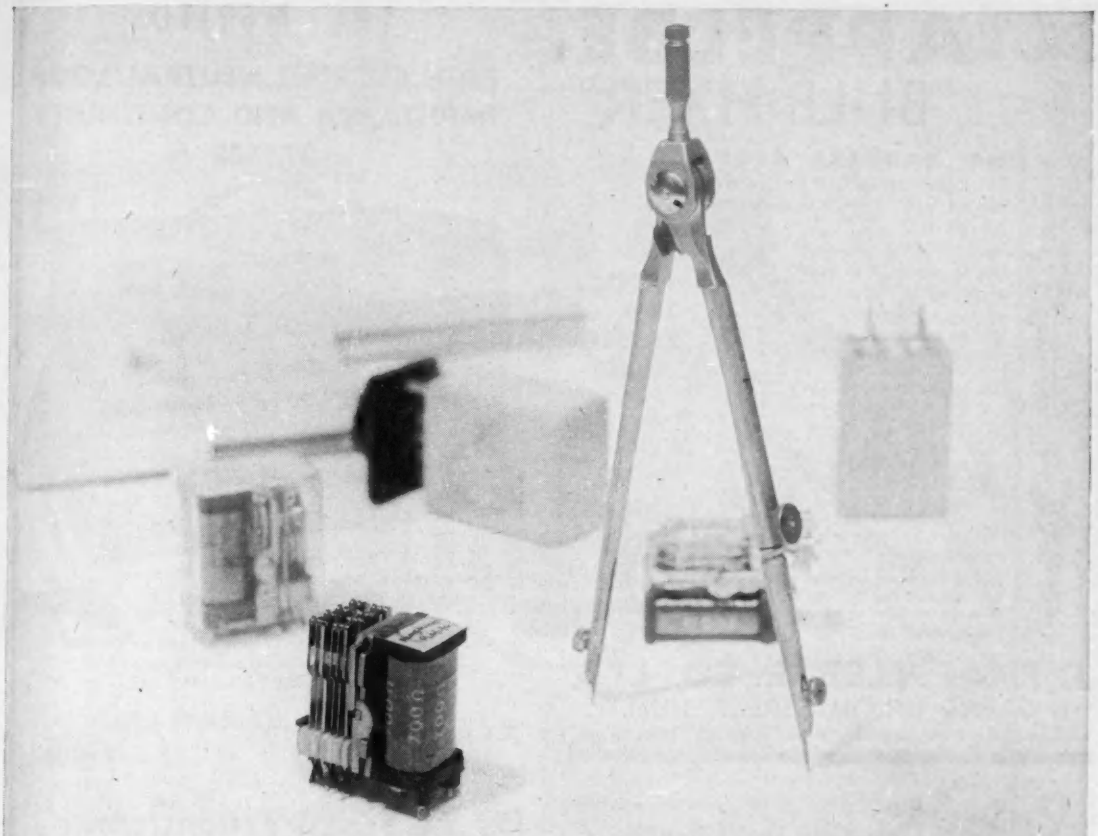

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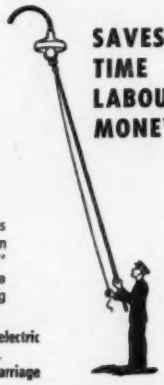

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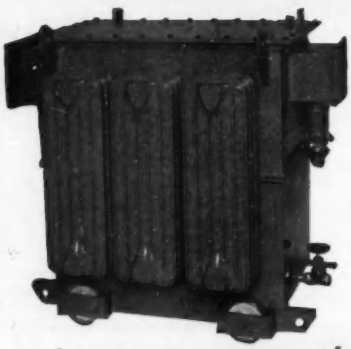

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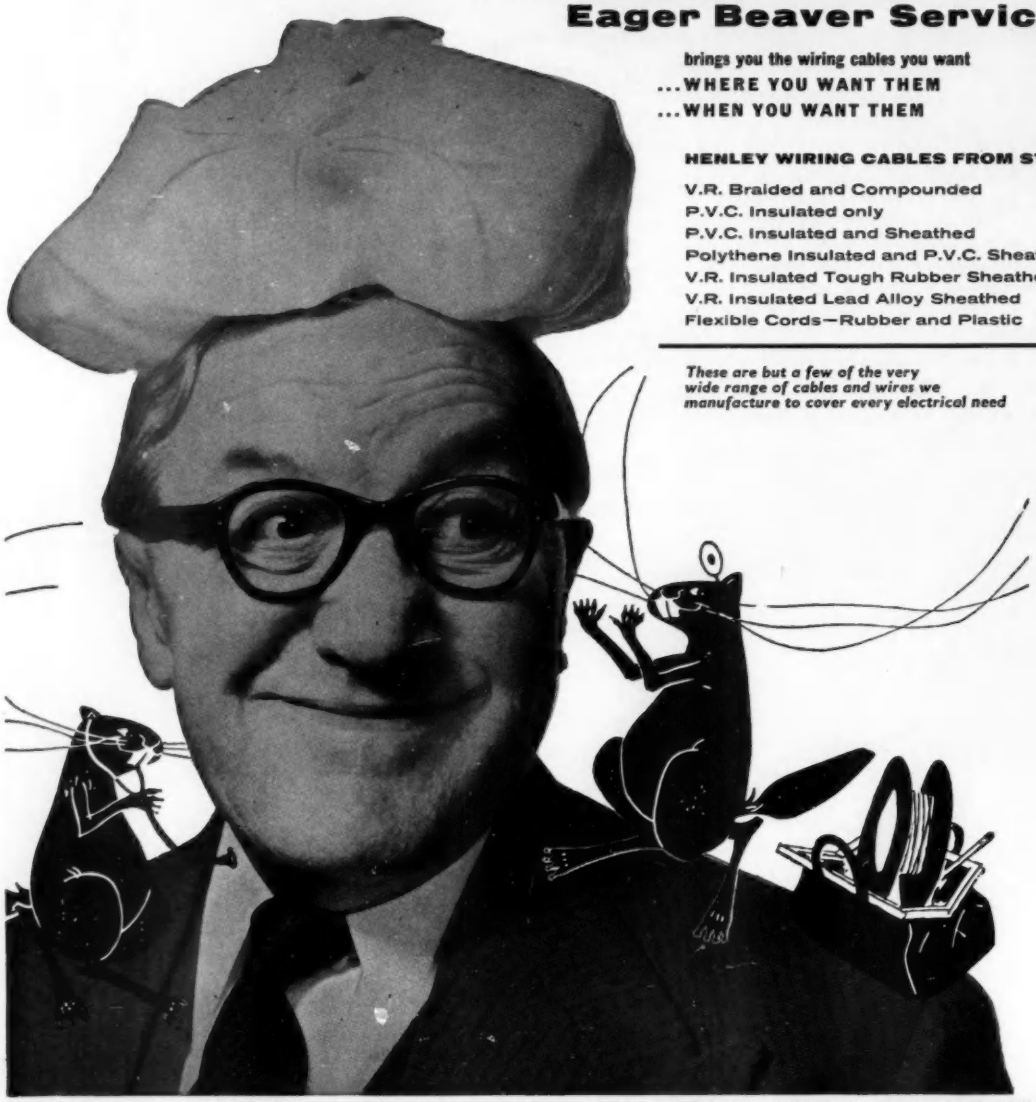

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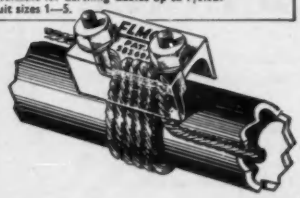

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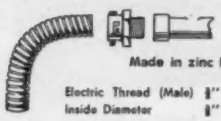

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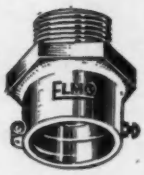

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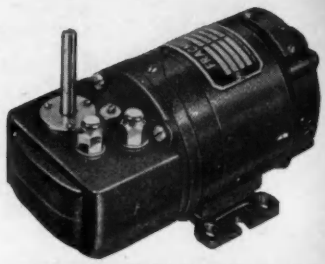

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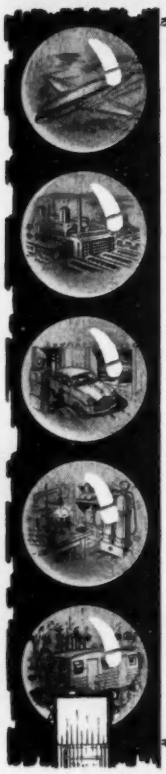

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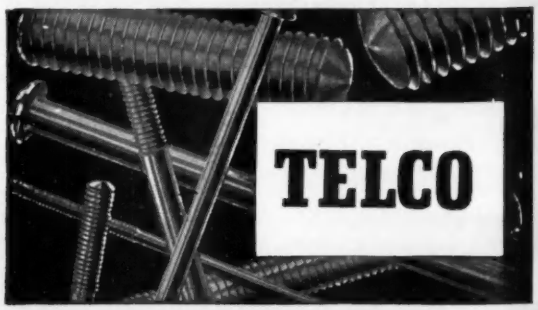

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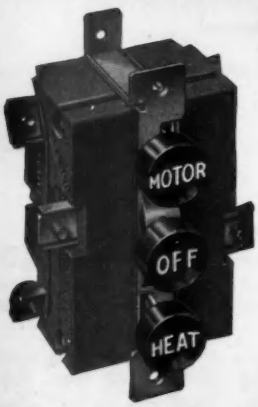
FOR HEATED WASHING MACHINES



Jelson PRESS BUTTON SWITCHES ARE A TECHNICAL ADVANCE WITH COMMERCIAL ADVANTAGE

Two AC only 15 amp 250 v D.P. Switches in one unit—ceramic insulation. Three varieties of operation—Independent, Interlocked sequence or Interlocked changeover. With or without manually reset Thermal trip for Heating Element and/or current overload trip for protecting Motor.

We shall be pleased to send full details.

JELSON ELECTRIC LTD. PHONE: ACO. 0866
SPRING ROAD, TYSELEY, BIRMINGHAM 11

Insuloid sas

Adjustable Cable Rack Saddles

Secure Cables at 2 POINTS with only 1 SCREW

Yes . . . every type, every size and every combination of cables are secured slickly, quickly and more efficiently than ever before with these Insuloid 2-point fixing Single Screw Adjustable Saddles. Designed for use with standard cable racking, the SAS Saddles are made from tough, virtually unbreakable, nylon to withstand the effects of most chemical and acid attacks, and providing for high insulation value, freedom from corrosion and electrolytic action. Leading users say "These Insuloid SAS Saddles are superb."

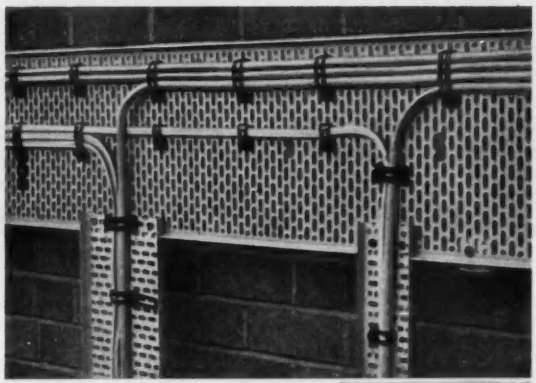
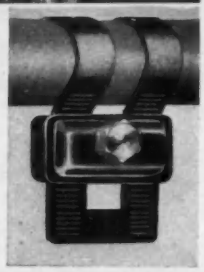


Illustration shows a portion of a typical SAS Saddle installation.

LOOK AT THESE ADVANTAGES

- *Two stock sizes secure all diameters and combinations of cables.*
- *No need for special Saddles to be made on site.*
- *Self-tensioning, anti-corrosive, high insulation value.*
- *Permits later additions or removals of cables.*
- *Cuts assembly time by 50%.*
- *Unbreakable in service.*



**A big brother has arrived! To fulfil many requests, INSULOID announce the addition of SAS 2 . . . a larger capacity Saddle . . . they're ready NOW!*

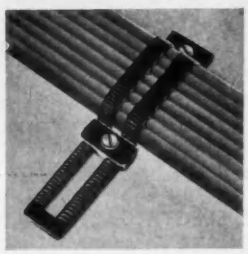


Illustration above shows how the complete AS Strap can be left uncut if future extensibility is required.

Insuloid as

Adjustable Saddles

Designed specially for wall and panel mounted wiring installations. The Insuloid AS Saddles have all the outstanding virtues of SAS Saddles, and three sizes only are required to cover even the most complex wiring assembly and at the same time considerably reduce time and costs, in addition to providing complete security with the highest insulative, anti-corrosive qualities in every climatic condition.

Fully descriptive literature on the Insuloid SAS Adjustment Saddles and AS Adjustable Saddles will be sent to you promptly at your request.

INSULOID MANUFACTURING CO. LTD.
Sharston Works, Leestone Avenue, Wythenshawe, Manchester
Telephone: Wythenshawe 2842 & 3163

Whenever it's Buzzers and Bell & Chime Transformers...

THE TRADE AGREE THAT—

It's a good job—It's AGRO!

THE 'SOHO' BUZZER

(Cat. No. 3460)

Adjustable diaphragm Buzzer of penetrating tone above ordinary noise level. On D.C. (3 to 4½v. battery) it gives a high frequency high pitched note and on A.C. (8 to 12v. Transformer) the tone is of medium pitch. Special windings of 12v. or 24v. D.C. can also be provided for use on buses, coaches, etc.

BELL AND CHIME TRANSFORMER

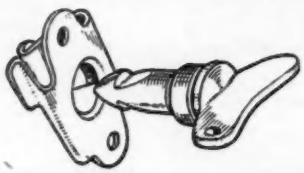
(Cat. No. 2941)

Brown bakelite base with attractive cream cover, primary 200/250v. secondary 4, 8 and 12v. 2-amperes. Fused Secondary.
A transformer of modern design with wax impregnated unit. Competitively priced.

Throughout the whole field of Electrical Apparatus and Accessories the name AGRO is widely respected for advanced design and sound manufacture. In addition to a comprehensive range of standard products, AGRO also supply specialised components to specification. Write now for Cat. No. 5710 illustrating AGRO'S full range of Bells, Bell Transformers and Lighting Accessories, etc.

AGRO ELECTRICAL CO. LTD. 60-66 WARDOUR STREET, LONDON, W.1. Telephone: GERRARD 0721/2. Works: AYLESBURY, BUCKS

ODDIE FASTENERS



The Fastener with endless applications. Simple, Positive, Self-locking. Made in a variety of types and sizes.

Special Fasteners to suit customers' requirements

WIDELY USED IN THE ELECTRICAL AND RADIO INDUSTRY

Department "E.R."

ODDIE, BRADBURY & CULL LTD.
SOUTHAMPTON

Telephone 55883 *Cables: "Fasteners, Southampton"*

If you need

a small **METAL PRESSING** for your product, why not consult us?

We specialise in light precision presswork in all metals for the Electrical Trades.

QUOTATIONS BY RETURN

BIRMINGHAM SPECIALITIES LTD.
80-81 Bath Street, Birmingham 4. *Phone: Central 2492*

FURSE

LIGHTNING CONDUCTORS
and Earthing Equipment

Largest Manufacturers and Exporters in Great Britain

Advisory and technical information service free — complete schemes and estimates. Illustrated literature on request.

W. J. FURSE & CO. LIMITED
33 Traffic Street (Tel. 83471-5 lines) NOTTINGHAM
Also LONDON, MANCHESTER, BIRMINGHAM, BRISTOL

WINDMILL LANE ESTATE
DENTON

ELECTRICAL CONTRACTORS
Plant Electrical Installations,
Hyde, Cheshire.

BUILDERS
Bentley Building Co. Ltd.
Oldham, Lancs.

ELECTRICAL INSTALLATIONS:

Volex

CABLES USED THROUGHOUT

VOLEX makes the point...

.....in fact VOLEX CABLES make no less than 1800 Lighting points and 1000 Socket points on this new housing estate.

The Windmill Lane estate at Denton, Lancs., is only one of the many housing sites where Volex Cables have been installed throughout.
Due to their proved qualities of endurance and complete reliability, more and more electrical contractors are using Volex Cables exclusively in building projects throughout the country.

"VOLEX" CABLES INCLUDE

- **VIR** Taped, Braided and Compounded. To B.S.S. 7, 1953, Table 22, Amendment 3.
- **TRS** To B.S.S. 7, 1953, Table 26, Amendment 3.
- **PIPVC** Polythene insulated PVC sheathed. To B.S.S. No. 1557 - 1954.
- **PVC** Insulated. To B.S.S. No. 2004-1955 Table 14.

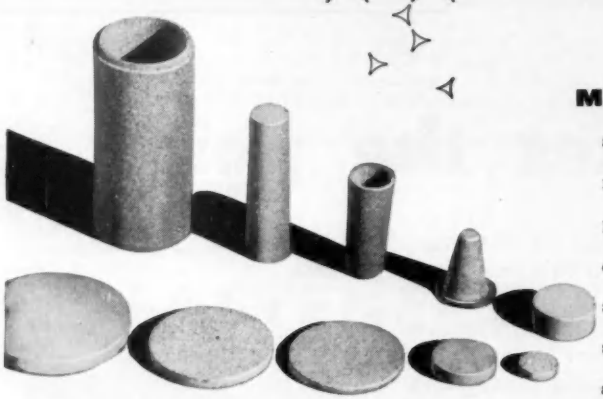
VOLEX ELECTRICAL PRODUCTS LTD.

Telephone : PENDLETON 4373. SALFORD 6. Telegrams : VOLEXPROD. Salford 6.

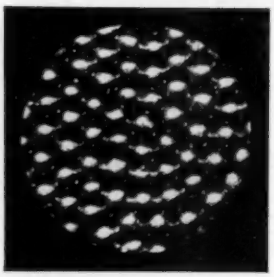
rigid-accurate bronze filters

graded for use with

all **liquids and gases**



Many years' experience in powder metallurgy has resulted in the development by BOUND BROOK of a porous material for the filtering of liquids and gases. It is produced from spherical metal powders of *closely controlled particle size* to give a rigid porous bronze structure of *uniform pore dimensions*. This metallic structure has excellent resistance to impact, is suitable for high pressure filtration in both directions of flow, and enjoys an almost indefinite life. The material is easily cleaned either by washing or by reversing the flow. Designed for such applications as Filter Elements, Flow Control Devices, Flame traps etc., Bound Brook bronze filters are available in six grades to suit required conditions, and in the form of discs, plates, cones, hollow cylinders etc. Special shapes can be made to suit customers' requirements. For further information send for leaflet "BOUND BROOK Bronze Filters".



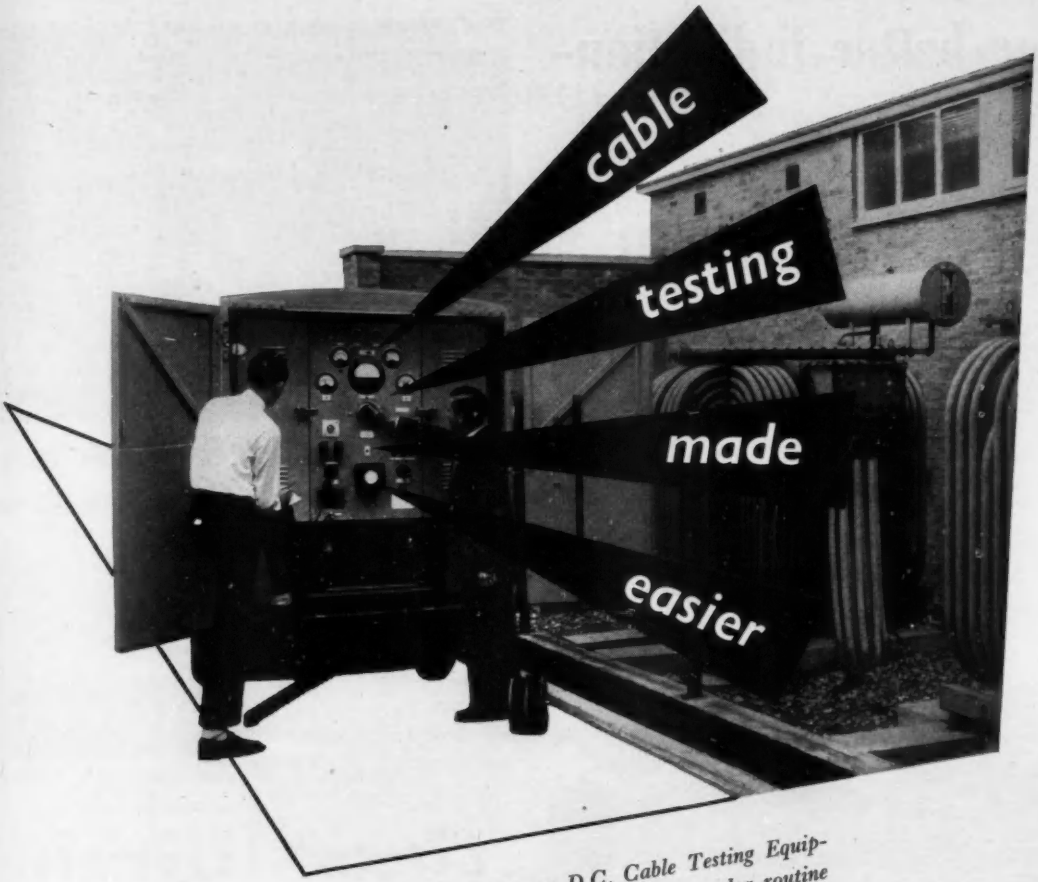
This microphotograph shows a section of a Bound Brook Filter. Note the porous structure formed by the use of spherical metal powder.

A MEMBER OF THE BIRFIELD GROUP

Bound Brook Bearings Limited

Trent Valley Trading Estate, Lichfield, Staffordshire

Telephone: Lichfield 2027-8 · Telegrams: Boundless, Lichfield



SenTerCet *High Voltage D.C. Cable Testing Equipments, portable or transportable, enable regular routine tests to be carried out and provide information which permits a higher level of maintenance, thus ensuring considerably longer cable life.* ***SenTerCet*** *High Voltage D.C. Cable Test Equipments are simple, reliable and robust. Their cost will be recovered in a few years by the pre-detection of deterioration which might lead to failure or, when failure has occurred, by speedy fault location which alone enables repairs to commence without delay.*

SenTerCet HV CABLE TEST EQUIPMENT

SenTerCet RECTIFIER EQUIPMENT

Write for Booklet F/CT.1

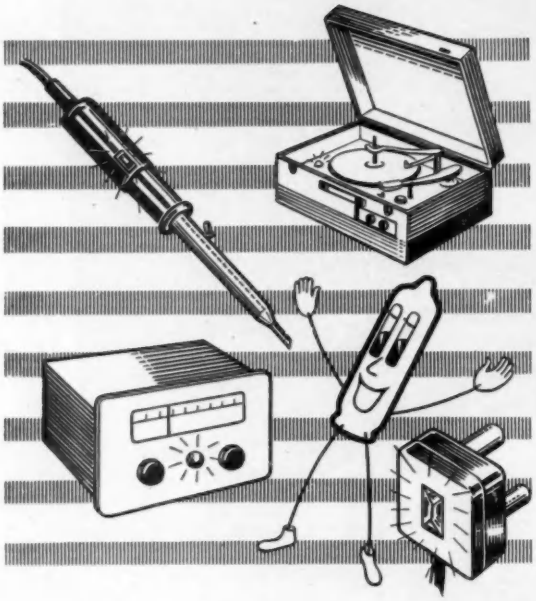
Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

H

For better indication— fit a Hivac neon



With its distinctive colour indication and almost indefinite life, a Hivac Neon is the best indicator for a wide range of domestic and industrial electrical equipment. Its easily-seen light serves as a visual check that an appliance is working as required. Look at the advantages:

- Extremely long life without sudden failure
- No filament to break
- Inexpensive and easy to instal
- Shock resistant
- Negligible power consumption
- Operation on a wide range of A.C. or D.C. voltages

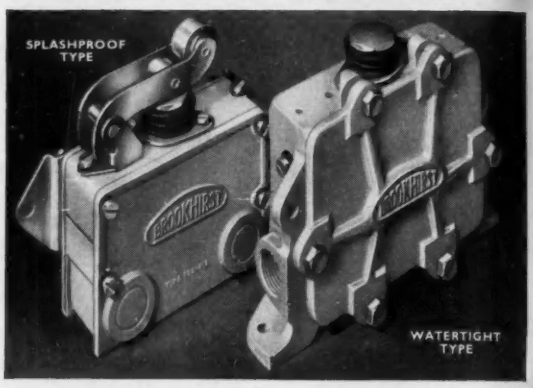
It just glows to show!

There's a type for every purpose —write for full details

Hivac Limited Stonefield Way, South Ruislip, Middlesex. Ruislip 3366

N6

FOR LIMIT SWITCHES



YOU CAN'T BEAT BROOKHIRST

Accuracy, reliability, long life—vitally important characteristics—are all embodied in Brookhirst snap action limit switches. However severe the conditions, you can depend absolutely upon their mechanical and electrical performance—tested to 20,000,000 operations. Full details in Leaflet 2103 —copy on request.

BROOKHIRST SWITCHGEAR LTD.
NORTHGATE WORKS, CHESTER

BROOKHIRST

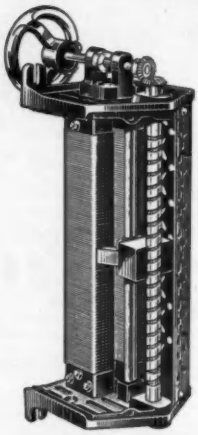
A METAL INDUSTRIES GROUP COMPANY CVS-41

Consult **Birch**

REGISTERED TRADE MARK

for

VARIABLE RESISTORS



Slate wound Resistors of fixed and variable type, incorporating oxidised nickel copper wire to B.S.S. 115.

Write for List No. 100

and for :

Asbestos Woven Mats | Strip Heating Elements
Loading Resistors | Stud Type Resistors
Motor Operated Resistors | Toroidal Resistors

VITREOUS ENAMELLED RESISTORS

Ferrule or wire end type: full range of 24 sizes—1½-250 watts. (List VE 190.)

Birch

REGISTERED TRADE MARK

H. A. BIRCH & CO. LTD.
WOOD STREET, WILLENHALL, STAFFORDSHIRE
Telephone WILLENHALL 494 · 495 · Grams WILOHM WILLENHALL
LONDON OFFICE : 1-5 NORTHOLT ROAD, HARROW, MIDDLESEX
Tel.: BYRON 5120

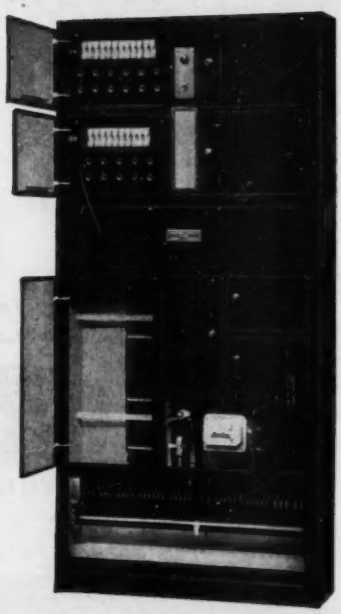
AEROFLEX

Fluvent

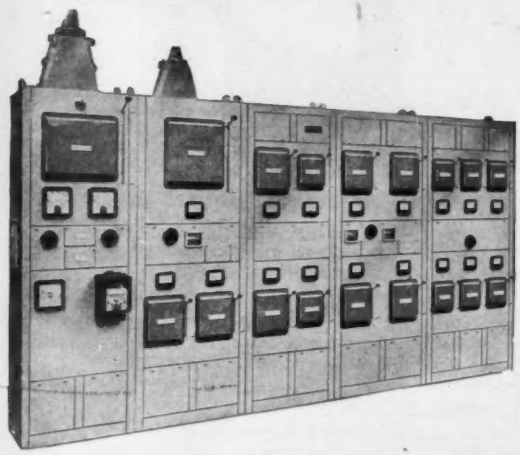
CUBICLE TYPE

SWITCHBOARDS

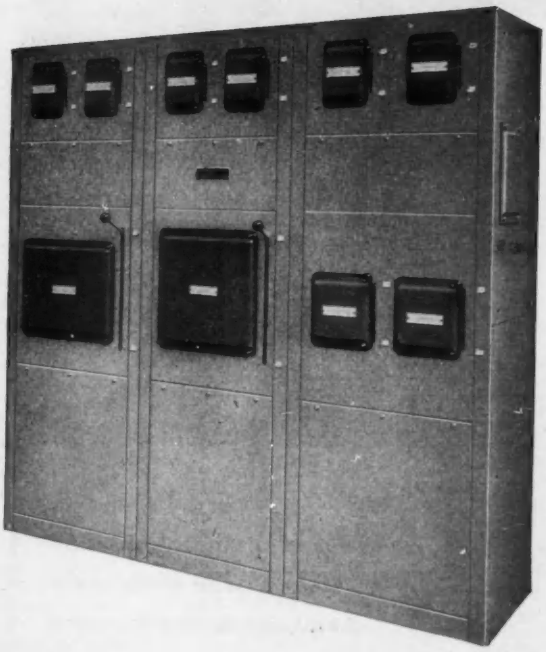
The name FLUVENT has been associated with advanced Switchboard design since the beginning of the century and the name AEROFLEX has been synonymous with high breaking capacity Fuses since they were first introduced in the early 1920's.



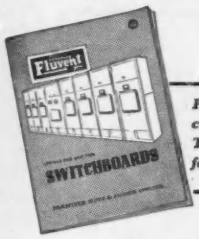
An unusual Cubicle Board (right) which provides a variety of lighting fuseboards with tumbler switch panels. It is installed in St. George's Chapel, Windsor.



Installed in a modern manufacturing undertaking, this Board (above) protects one 300 amp. eight 100 amp. and eight 60 amp. 3 phase 4 wire outgoing circuits, and the incoming Cubicle on the left is provided with a 600 amp. main switch and metering facilities.



A compact Board (right) protecting one 300 amp. and two 60 amp. 3 phase 4 wire circuits and six 30 amp. single phase and neutral circuits, all under the control of a 600 amp. T.P. and Neutral incoming main switch.



Publication SB3 illustrates and describes a selection of Cubicle and Unit Type Switchboards. A copy will be forwarded to you on request.

Parmiter Hope & Sugden Ltd.

FLUVENT ELECTRICAL WORKS · LONGSIGHT · MANCHESTER 12

London: 34 Victoria Street, S.W.1. Glasgow: 5 Somerset Place, C.3. Birmingham: 39/41 Carrs Lane, 4.

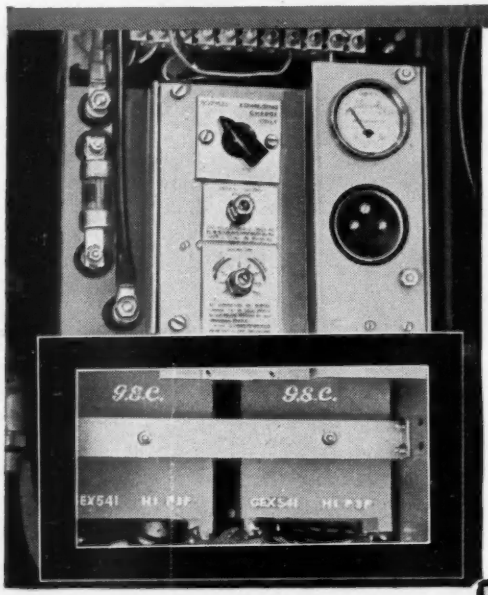
dmPH1149

Strength without muscles!

for their latest Fork-lift Truck Lansing Bagnall chose

G.E.C.

GERMANIUM RECTIFIERS

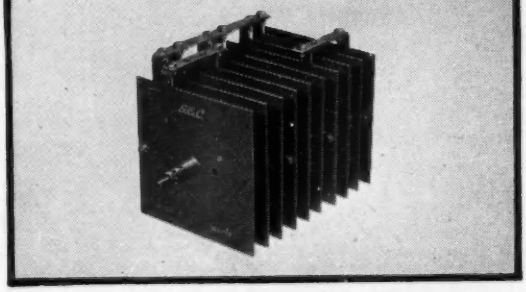


for compactness
Small size is very important in this application. The new GEX 541 rectifier stack gives maximum rectified power per unit volume.

for lightness
Germanium Rectifiers are the lightest type of rectifier available for most applications. The GEX 541 weighs only 10% of the equivalent conventional rectifier.

for efficiency
Like all germanium rectifiers in the G.E.C. range, the GEX 541 offers low forward resistance and corresponding increases in efficiency and regulation.

The BASIC GEX 541 is a germanium junction diode. Single units are available for such applications as DC blocking and gating. Complete rectifier stacks can be supplied, finned or unfinned, suitable for currents up to 160 amps. or D.C. output voltage of up to 900 volts.



For Data Sheets and further information please write to the Semi-conductor Division

THE GENERAL ELECTRIC COMPANY LIMITED
MAGNET HOUSE · KINGSWAY · LONDON W C 2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Advertisements are accepted up to first post on Monday of the week of issue
If displayed with boxed rules, name or symbol block by Friday prior to week of issue
All communications to be addressed to:
Classified Advertisement Department, ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1
Original testimonials should not be sent with applications for employment

CHRISTMAS

ADVERTISEMENTS for the issue of 26th December have now closed for press.

OFFICIAL NOTICES, TENDERS, ETC.

PENGE URBAN DISTRICT COUNCIL

Street Lighting

TENDERS are invited from the manufacturers of Electrical Street Lighting Equipment for the supply of equipment, columns, etc., and for the erection and complete installation of :—

(a) 11 Class "A" Lamps (Mercury Vapour Lighting).

(b) 570 Class "B" Lamps.

Alternative tenders requested for :—

Mercury Vapour, Sodium, Fluorescent Lighting.

Further particulars, outline specification and forms of tender may be obtained upon application, and payment of a deposit of 10 guineas (returnable upon receipt of a bona fide tender, not subsequently withdrawn), to the Engineer and Surveyor, Town Hall, Anerley Road, London, S.E.20.

Tenders complete with comprehensive specifications are to be returned to the undersigned by noon on Thursday, 8th January, 1959.

PERCY J. BUNTING,
Clerk of the Council.

Town Hall,
Anerley Road,
London, S.E.20. 5800

CITY OF NORWICH

Improvement of Street Lighting on Main Traffic Routes, 1958/59

TENDERS are invited for :—

1. Supply of 163 tubular 25-ft. steel lamp columns.
2. Erection and part connection 160 columns, etc.
3. Supply of 83 250-watt cut-off MBF/U lanterns and 83 3 × 80-watt tubular fluorescent lanterns.
4. Supply of 83 sets of MBF/U control gear and lamp and 243 tubular 80-watt fluorescent lamps.

Tenders may be submitted for items 1, 2, 3 or 4.

Copies of tender documents may be obtained from the City Engineer, City Hall, Norwich. Drawings may be inspected during normal working hours at the City Engineer's office.

Completed tenders are to be received not later than 10 a.m. on Saturday, 3rd January, 1959.

The Council does not bind itself to accept the lowest or any tender. 5842

COUNTY BOROUGH OF SWANSEA

Borough Architect's Department

Trallwn County Primary School Electrical Installations

FIRMS wishing to tender for ELECTRICAL INSTALLATIONS at this School are invited to submit their application to the Borough Architect, The Guildhall, Swansea, on or before 26th December, 1958.

Plans, specification and conditions of contract can be obtained on application, and deposit of TWO POUNDS for each tender, provided the applicant gives satisfactory evidence of having previously carried out work of a similar character.

The deposit will be refunded after delivery of a bona fide tender (not subsequently withdrawn) and the return of all documents.

No guarantee is given that the lowest or any other tender will be accepted.

T. B. BOWEN,
Town Clerk.

The Guildhall,
Swansea.
10th December, 1958. 5825

SITUATIONS VACANT

ASSISTANT STATION SUPERINTENDENT
ASSISTANT MAINS ENGINEER
ASSISTANT CONSUMERS' ENGINEER
INSPECTOR

required by ADEN GOVERNMENT ELECTRICITY DEPARTMENT on contract for one tour of 18-24 months in first instance. Gratuity at rate of £150 a year. Salary according to qualifications and experience in scales shown. Supplementary pay differential from £96 to £144 a year for family men. Outfit allowance up to £60. Free passages for officer and wife. Free passages for up to four children and/or allowance up to £288 annually towards cost education in U.K. Liberal leave on full salary. Candidates should be preferably under 45 years of age.

ASSISTANT STATION SUPERINTENDENT (M2C/50411/EF).

Salary scale (including pay differential) £1,040 rising to £1,844 a year. Candidates must have served apprenticeship in engineering works and have had considerable experience in the operation of a modern steam generating station. They should preferably hold a recognised engineering qualification. Experience with diesel plant an advantage.

ASSISTANT MAINS ENGINEER (M2C/50412/EF).

Salary scale (including pay differential) £1,040 rising to £1,844 a year. Candidates should have had sound technical training and experience in the design and construction of overhead and underground distribution systems up to and including 33 kV. Possession of appropriate technical qualifications an advantage.

ASSISTANT CONSUMERS' ENGINEER (M2C/50414/EF).

Salary scale (including pay differential) £1,040 rising to £1,579 a year. Candidates should have technical training and experience in the utilisation of electrical energy in industrial, commercial and domestic premises, knowledge of installation work, and be conversant with tariffs, sales and all aspects of consumer service. H.N.C. an advantage.

INSPECTOR (M2C/50413/EF).

Salary scale (including pay differential) £1,040 rising to £1,579 a year. Candidates, preferably possessing C. and G. Full Tech. Cert. in Electrical Installation Work or equiv., must have completed full apprenticeship covering extensive branches of electrical work or with an E.C.A. registered contractor. They must have experience in inspection and testing of all types of installation, and in administration of I.E.E. regulations.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote reference number against post applied for. 5805

BERMUDA ELECTRIC LIGHT CO. LTD.

Cable Jointer

THE company have a vacancy for a 1st class high (to 33 kV) and low tension cable jointer. Three-year contract offered in first instance.

Assistance will be given by the company to find unfurnished accommodation if necessary. Pension scheme operated.

Applicants should forward full details of themselves, their training and experience to: Messrs. Mackness & Shipley, Consulting Engineers, Parliament Mansions, Abbey Orchard Street, London, S.W.1, quoting reference 2203/61. 5784

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

Third Assistant Engineer (Planning and Development), Area Headquarters

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER in the Planning and Development Department at the Area Offices, Hamilton.

Applicants should have received a sound engineering training with subsequent experience in the planning and development of large H.V. and L.V. industrial and rural distribution systems. They should be conversant with load flow diagrams and voltage drop and fault level calculations. Applicants should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A, the present classification and grading being L.10, salary £995/£1,055 per annum. This post is superannuable subject to satisfactory evidence of health.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton. 5827

UNIDARE LIMITED

Finglas, Dublin, Ireland

has a vacancy for

DISTRIBUTION TRANSFORMER DRAUGHTSMAN.

Applicants should have experience in the draughting of transformers up to 1,500 kVA.

This appointment will carry an attractive salary with the benefit of non-contributory staff pension scheme and a contributory health insurance scheme.

Apply, quoting reference BGC/DON/MS, giving full details of experience. 5807

EASTERN ELECTRICITY BOARD

Chilterns Sub-Area Headquarters
(135/58.R)

THIRD ASSISTANT ENGINEER (Operation and Maintenance). Duties will include assistance in the commissioning of substations up to 33 kV, pressure testing, fault location and calculation of protective gear settings.

Salary N.J.B. Class L, Grade 10 (£995-£1,055).

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford, by 2nd January, 1959. 5841

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER
(Operation and Test),
BARKING "C" POWER STATION
(Vacancy No. 58/1051).

Successful applicant will be required to carry out, under the Operation and Efficiency Engineer, investigations into plant performance, assist in statistical work, collect information for various returns, assist in drawing up new operating routines, compile operation sketches and information, and generally assist the Operation and Efficiency Engineer. Salary Class J, Grade 10 = £935 p.a.

ASSISTANT SHIFT CHARGE ENGINEER,
BARKING "C" POWER STATION
(Vacancy No. 58/1052).

Extensive experience necessary in operation of modern high-pressure turbine and boiler plant, E.H.T. switchgear, and in administration and control of labour. Preference given to those with pulverised fuel experience. Salary Class J, Grade 8 = £1,045 plus £99 10s. shift p.a.

ASSISTANT ENGINEER (Operation),
WOOLWICH POWER STATION
(Vacancy No. 58/1053).

Sound technical training with experience of power station plant operation. Duties will include relief for other shift engineers. Salary Class H, Grade 9 = £935 plus £88 10s. shift per annum.

SECOND ASSISTANT ENGINEER,
TELECOMMUNICATIONS SECTION,
TECHNICAL DEPARTMENT,
DIVISIONAL H.Q.
(Vacancy No. 58/1054).

Ability required to take charge of a section consisting of ten engineers and twenty other staff engaged in the maintenance of a private communication network, including P.A.X. telephones and V.H.F. radio, and a central indicating system covering the generating station and offices of the London Division. Experience is required in modern automatic telephone, electronic and telemetering techniques. Qualifications, A.M.I.E.E. or equivalent. Salary Class AX/EX, Grade 3 = £1,380/£1,655 per annum.

THIRD ASSISTANT ENGINEER,
TELECOMMUNICATIONS SECTION,
TECHNICAL DEPARTMENT,
DIVISIONAL H.Q.
(Vacancy No. 58/1055).

A contingent vacancy may occur as Assistant to the Second Assistant Engineer above (Vac. No. 58/1054). Similar knowledge and experience is required. Salary Class AX/EX, Grade 5 = £1,105/£1,370 p.a.

THIRD ASSISTANT ENGINEER,
TECHNICAL DEPARTMENT,
DIVISIONAL H.Q.
(Vacancy No. 58/1056).

Ability required to take charge of a section consisting of three engineers dealing with automatic voltage regulators and generator excitation problems. Experience is required in the commissioning and maintenance of automatic voltage regulating equipment and good acquaintance with the theory and design of such apparatus. Applicants should also have a thorough knowledge of alternator excitation circuits and equipment. Salary Class AX/EX, Grade 5 = £1,105/£1,370 p.a.

THIRD ASSISTANT ENGINEER,
TECHNICAL DEPARTMENT,
DIVISIONAL H.Q.
(Vacancy No. 58/1057).

A contingent vacancy may occur as Assistant to the Third Assistant Engineer (Vac. No. 58/1056). Similar knowledge and experience is required. Salary Class AX/EX, Grade 6 = £945/£1,190 p.a.

ASSISTANT SHIFT CHARGE ENGINEERS, BLACKWALL POINT POWER STATION
(Vacancy No. 58/1064).

Sound technical training with practical experience in operation of modern power station, preferably with pulverised fuel firing. Salary Class F, Grade 9 = £830 plus £79 shift work per annum.

ASSISTANT MAINTENANCE ENGINEER (Mechanical),
BLACKWALL POINT POWER STATION (Vacancy No. 58/1065).

Sound engineering training with experience in repair and maintenance of modern generating plant. Salary Class F, Grade 8 = £885 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 29th December, 1958. 5819

We have been retained by an internationally known Company in Birmingham, to advise on the following appointments:—

ELECTRICAL ENGINEER

Applications are invited from candidates with the following qualifications and experience:—Honours Degree in Engineering (Electrical). Membership of the Institution of Electrical Engineers. All round electrical experience, coupled with considerable knowledge of development in modern electronic techniques. The capacity to lead and supervise staff responsible for all electrical design as applied to the Company's products in the field of measuring and handling operations. Liaison with sub-contractors supplying bought out components, and with the Company's customers in respect of electrical features of special products.

The appointment is progressive and offers considerable scope to a first-class man. Salary scale is around £2,000 p.a. to commence. Ideal age 35.

SENIOR DESIGN DRAUGHTSMEN

Several vacancies exist for Senior Draughtsman of H.N.C. standard. The work is both original and interesting, and will appeal to draughtsmen with a knowledge of hydraulic, pneumatic, and electrically operated mechanisms associated with mechanical handling and measuring devices.

The work entails a measure of experimental development necessary to prove new designs.

Salary envisaged is between £900 and £1,100 p.a. according to age and experience. Candidates should be in the age group 30/33.

The Company offers pension schemes and welfare facilities of a very high order.

Applications in writing will be treated as confidential, and should be addressed to

H. Jackson & Partners
109 Colmore Row
Birmingham 3
Telephone: CENTRAL 4920

5815

PILKINGTON BROTHERS LIMITED

require an

ELECTRICAL ENGINEER

to take charge of the power frequency section of a high-voltage laboratory using experimental voltages up to 1,300 kV.

The preferred age range is 25-30 and an appropriate university degree is a qualification.

Applications stating age, qualifications, experience and present salary should be addressed to :—

Personnel Officer (Graduate Recruitment)
PILKINGTON BROTHERS LIMITED
St. Helens, Lancashire

5804

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

THIRD ASSISTANT ENGINEER,
TRANSMISSION (Construction) DEPARTMENT
(Vacancy No. 186/58/ER).

Duties will be connected with the construction of high-voltage transforming and switching substations and will include contractual correspondence and site supervision. Candidates should have experience in construction or maintenance of similar plant and should possess qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 6 (£895-£1,140 per annum) of Schedule B of the National Joint Board Agreement.

Closing date for receipt of applications, 27th December, 1958.

PLANT SHIFT CONTROL ENGINEERS,
DRAKELOW "A" POWER STATION
(Vacancy No. 187/58/ER).

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National standard desirable.

The salary will be in accordance with Class J, Grade 10 (£885 - £930 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 27th December, 1958.

STATION SHIFT CONTROL ENGINEERS,
DRAKELOW "A" POWER STATION
(Vacancy No. 188/58/ER).

Applicants should have had a good general education and technical training with practical experience in the control and operation of large modern switchgear. Preference will be given to candidates who possess technical qualifications to Higher National standard.

The salary will be in accordance with Class J, Grade 10 (£885 - £930 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 27th December, 1958.

STATION SHIFT CONTROL ENGINEER,
WILLINGTON "A" POWER STATION
(Vacancy No. 184/58/ER).

Applicants should have had a good general education and technical training with practical experience in the control and operation of large modern switchgear. Preference will be given to candidates who possess technical qualifications to Higher National standard.

The salary will be in accordance with Class K, Grade 10 (£935-£995 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 27th December, 1958.

PLANT SHIFT CONTROL ENGINEERS,
DRAKELOW "B" POWER STATION
(Vacancy No. 189/58/ER).

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience. Technical qualifications to Higher National Certificate desirable. The ultimate capacity of this station will be 480 MW.

Salary will be in accordance with Class J, Grade 10 (£885 - £930 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 27th December, 1958.

These appointments will be pensionable under the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

O. S. WOODS,
Divisional Controller.

11th December, 1958. 5829

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

South Caledonia Area

APPLICATIONS are invited from suitably qualified engineers for the following vacancy :—

ASSISTANT CONSTRUCTION AND MAINTENANCE ENGINEER.

Applicants, who should preferably have an H.N.C. or equivalent qualifications in electrical engineering, will be required to take charge of a maintenance and construction gang, whose main functions would be the maintenance of the 132-kV network as well as the construction and maintenance at 33 kV and below. Suitable candidates with limited experience in one of the fields above would be given some training in the Perth Headquarters. The successful applicant would be stationed at Arrochar, Dunbartonshire.

The conditions of employment would be in accordance with the N.J.B. Agreement, salary according to Schedule A, Grade G.7, which is £935/£995 per annum.

Application forms, which can be obtained from A. Grant, Esq., B.Sc., M.I.E.E., Area Manager, Blackfriars, Perth, should be completed and returned within fourteen days of the date of this advertisement. 5833

ASSISTANT POWER SUPERVISORS

are required by the

UNITED KINGDOM ATOMIC ENERGY AUTHORITY, INDUSTRIAL GROUP,

at Chapelcross Works, Annan, Dumfriesshire, Scotland, to assist the Power Plant Supervisor on shift work in the efficient operation of electrical and mechanical power plant comprising an 11-kV, 3.3-kV and 415-v. electrical system, steam raising heat exchangers, turbo-alternators, associated auxiliaries and a circulating water system.

Applicants must have served a recognised engineering apprenticeship. Experience in a conventional power station and possession of an O.N.C. or equivalent may be an advantage.

Salary £875 (at age 30 or over) to £1,050 per annum.

Contributory superannuation. Staff housing scheme.

Send postcard for application form, quoting reference 2831/J7, to Works Secretary, at above address.

Closing date 5th January, 1959. 5801

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Our Ref. 149/2/RS/EB
Vacancy No. 134/ER/58

Appointment : Generation Engineer

APPLICATIONS are invited from suitably qualified engineers for the post of GENERATION ENGINEER at DIVISIONAL HEADQUARTERS, CARDIFF.

Experience in co-ordination and the general management, operation and maintenance of power stations essential.

The salary will be in accordance with Class B, Grade 8, of the National Joint Managerial and Higher Executive Grades Committee (£2,300 to £2,500 per annum).

Applications, stating details of engineering and management training and experience, should be addressed to the Divisional Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Rd., Gabalfa, Cardiff, so as to reach him not later than 31st December, 1958. 5826

EAST AFRICA

ELECTRICAL ENGINEER/ESTIMATOR required for service with progressive contracting company.

Applicants must be capable of estimating for large contracts and taking complete charge of a branch. Remuneration commensurate with experience and qualifications.

Write giving full personal details, experience, etc., to—Box 5754.

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following positions :—

THIRD ASSISTANT ENGINEER (Shift Control), BRISTOL GROUP.

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (Industrial and Commercial Development), PLYMOUTH.

Third Assistant Engineer (Shift Control), Bristol Group.

It has been decided to establish a Distribution Control for the Bristol Group of Districts with the Control Room at Electricity House. When the Control Room is fully operational, which it is anticipated will be in nine to twelve months' time, it will be staffed on a five-man rota basis.

The shift engineers will have control over all E.H.V. and H.V. switching operations, and will have responsibilities for maintaining the diagram board as a correct representation of the network, and other operational matters.

Applications are now invited for the first of the shift engineer vacancies. This position offers unique opportunities in that the successful applicant will be concerned with the design of the building, the setting up of the diagram board and an appraisal of the communication facilities needed.

Applicants should have had a wide experience of operating an extensive E.H.V. network under both normal and fault conditions, and should possess a minimum technical qualification equivalent to the Higher National Certificate in Electrical Engineering.

Salary according to Class L, Grade 9 (£1,065 × £25 to £1,140 per annum) of the N.J.B. Agreement, plus 10% enhancement for shift duties when the Control Room becomes operational.

APPLICATIONS to be made on official form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from Group Administrative Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1. Closing date for receipt of completed applications is Wednesday, 7th January, 1959.

Third Assistant District Commercial Engineer (Industrial and Commercial Development), Plymouth.

Salary according to Class G, Grade 9 (£835 × £15 to £880 per annum) of the N.J.B. Agreement.

The candidate appointed will be responsible to the First Assistant District Commercial Engineer for industrial and commercial sales, with particular reference to the development of thermal storage installations.

A knowledge of heat loss calculations and heating design techniques is essential, and the possession of qualifications equivalent to Higher National Certificate in Electrical Engineering is desirable. Possession of a current driving licence is desirable.

APPLICATIONS to be made on official form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from District Manager, South Western Electricity Board, Armada Street, Plymouth. Closing date for receipt of completed applications is Wednesday, 7th January, 1959. 5831

CENTRAL ELECTRICITY GENERATING BOARD

FUEL TECHNOLOGY AND COMBUSTION SCIENTIST required in the Fuel and Combustion Section of the Research and Development Department at Headquarters, London, E.C.1.

Candidates should possess a good university degree in chemistry with a bias towards physical chemistry, and membership of the Institute of Fuel would be an advantage. They should have research experience preferably, but not necessarily, in fuel technology. The successful candidate will be expected to propose, arrange and guide researches connected with fuels and combustion.

Salary on a scale within the range £1,540-£2,005 according to duties and responsibilities.

Application forms obtainable from I. G. Ellis, Personnel Officer, 24/30, Holborn, London, E.C.1, should be completed and returned by 2nd January. Please mark envelopes "Confidential, Ref. ER/386." 5818

THE ELECTRICITY COUNCIL

Appointment of Resident Pole Inspectors

THE Electricity Supply Industry invite applications for the appointment of superannuable posts of RESIDENT POLE INSPECTORS at Ellesmere Port (Cheshire); North Shields; Staddlethorpe, near Hull; Charlton (London); and Boston (Lincs). The appointments will be made by the appropriate Electricity Boards, and applicants should state in their applications whether they have a preference for any particular district.

The duties will include the inspection and control of the selection, preparation and preservative treatment of wood poles at pole and creosoting depots. Applicants should be physically fit, and experience or knowledge of timber preservation and/or overhead line construction including handling and transport of wood poles would be advantage. The ability to prepare records and to deal with occasional correspondence is essential. Successful candidates will be given a period of specialised training in these duties.

The salary for each post will be within the scale £795 × £25 to £870 p.a.

Applications to be made on forms obtainable from E. Landucci, Winsley Street, London, W.1, and returned not later than 2nd January, 1959. Quote ref. C/24. 5817

DESIGNER/DRAUGHTSMAN

with experience in design of air break circuit breakers up to 2,000 amperes for medium-voltage A.C. applications and complying with B.S. and A.S.T.A. requirements.

This post is permanent and offers excellent opportunity for man with initiative capable of accepting responsibility and working with minimum supervision.

Salary commensurate with experience and technical qualifications.

Married men will receive assistance towards house purchase if necessary. Applications treated in strict confidence.—Box 615, Rex Publicity, 10, Clairmont Gardens, Glasgow, C.3.

354

ALDERNEY ELECTRICITY LTD.

Alderney, Channel Islands

RESIDENT MANAGER required for Statutory Island Electricity Supply Company with output approaching one million units per annum from an A.C. diesel generating station. The distribution network consists of overhead and underground 11 kV and L.V. mains. One showroom. Contracting carried out. Applicants should be energetic practical engineers with operating and contracting experience. The company is associated with and guided by Christy Bros. Ltd.

Starting salary approx. £750 p.a. having regard to applicant's experience with progressive increases depending on resulks obtained.

Full details of age, experience, qualifications and salary required should be given in the application which should be made in writing to Christy Bros. Ltd., Electrical Engineers, Chelmsford, Essex, England. 5799

SOUTH EASTERN ELECTRICITY BOARD

SENIOR DEMONSTRATOR, Folkestone and Ashford District. Salary £640 × £20 to £700 per annum under N.J.C. Grade 2. Superannuable.

Applicants should have diploma or certificate in domestic science, also E.A.W. Certificate. Duties include lecturing, demonstrating, advising consumers, training junior demonstrators and generally assisting in any of the District's showrooms.

Applications, quoting reference TER, and naming two referees, to District Manager, SEEBOARD, York House, Cheriton Gardens, Folkestone, by 31st December, 1958.

GEORGE WRAY,
Secretary. 5830

***Situations Vacant** (continued)*

DAVY - UNITED

Assistant Electrical Engineer

required for Construction Division. Must have served a full apprenticeship, with subsequent experience in high, medium and low-voltage distribution, the layout and installation of steelworks substations, motor rooms, rolling mills, etc., and cabling systems thereof. A good knowledge of electrical power system protection is necessary.

Applicants should also have a Degree or Higher National Certificate and be Graduate I.E.E., or have passed all examinations necessary for A.M.I.E.E.

The successful applicant may be required to travel abroad. Salary commensurate with qualifications and experience. Contributory pension scheme.

Apply in writing with full details to Personnel Department, Davy and United Engineering Co. Ltd., Darnall Works, Sheffield, 9. 5806

SOUTHERN ELECTRICITY BOARD

Field Engineer (Construction)

Sub-Area Engineering Department of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge. Salary N.J.B. Class I., Grade 13 (£885-£930 per annum, inclusive of London allowance).

The duties of the post will be to carry out the installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work on all distribution systems up to and including 11 kV.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.969, not later than 29th December, 1958. 5816

THE UNIVERSITY OF LEEDS

Department of Electrical Engineering

APPLICATIONS are invited for appointment as LECTURER or ASSISTANT LECTURER in the Department of Electrical Engineering; duties will include teaching and research in microwave engineering.

Salary on scale £900 × £50 to £1,350 (efficiency bar) × £75 to £1,650 a year for a Lecturer, or within range £700-£850 a year for an Assistant Lecturer, according to age, qualifications and experience.

Applications (three copies) stating date of birth, qualifications and experience, together with the names of three referees, should reach the Registrar, The University, Leeds, 2 (from whom further particulars may be obtained) not later than 12th January, 1959. 5802

BERMUDA ELECTRIC LIGHT CO. LTD.

THE company have a vacancy for a first-class REFRIGERATION MECHANIC. Three-year contract offered in first instance. Assistance will be given by the company to find unfurnished accommodation if necessary. Pension scheme operated.

Applicants should forward full details of themselves, their training and experience to: Messrs. Mackness & Shipley, Consulting Engineers, Parliament Mansions, Abbey Orchard Street, London, S.W.1, quoting reference 2203/65.

5834

HALL ENGINEERING LIMITED

Shrewsbury

ELECTRICAL ENGINEER

A MAN with a strong practical background is required, having sound knowledge of A.C. and D.C. control schemes and power supplies generally, to work in conjunction with design engineers on a variety of interesting projects.

Applicants should be capable of carrying out design work, and preference will be given to men possessing at least Higher National and between 35-40 years of age.

Applications in writing, giving full details and salary required, to Chief Draughtsman, Hall Engineering Ltd., Shrewsbury. 5832

ESTIMATING ENGINEERS

SCOTTISH Electrical Contractors presently setting up an organisation in London to handle expanding overseas operations require Estimating Engineers.

Minimum qualification 10 years' experience in the electrical contracting industry.

Offices in London, adjacent Waterloo Station.

Box 5828

ADMIRALTY. Trainee electrical draughtsmen required for unestablished appointments in Bath. Candidates must be British subjects aged 21 and upwards and have been apprenticed or had equivalent workshop experience in one or more branches of electrical engineering in factories or shipyards. Free training in drawing and electrical engineering technology for four months beginning February, 1959, at Bath Technical College. Salary during training £510 (age 21) to £685 according to age and experience, increased (except at age 21) on satisfactory completion of training. Five-day week. 18 days' annual leave. Substantial grants towards travelling expenses for all candidates called for interview. Apply giving details of age, technical qualifications, apprenticeship (or equivalent) and experience to—Director General Ships, Admiralty Offices, Foxhill, Bath. 5808

BRENTFORD TRANSFORMERS Ltd. have a vacancy for a senior sales engineer. The position which is well paid and offers chance of promotion, pension scheme and local accommodation, is open to a man with a good engineering knowledge in the control and rectifier field. A certain amount of organising ability is also required. Applications to—Sales Director, B.T.L., Manor Royal, Crawley, Sussex. 5705

CIRCUIT engineer. Young man, age 22/26, required for circuitry work associated with automatic control gear. O.N.C. standard preferred. Permanent and progressive position. Pension scheme. Canteen. Apply in writing giving full details of age, experience and qualifications, if any, to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Rd., Hounslow, Middlesex. 5593

COMMERCIAL assistants (engineering) required by the British Thomson-Houston Co. Ltd. The work involves the handling of enquiries and orders for small industrial electric motors, both home and export. Some knowledge of electrical engineering practice would be of advantage and applicants should have a minimum of National Certificate of Education at Ordinary level. The vacancies are open to men not over 30 years of age who are free of National Service commitments. Continuity of employment and good prospects are assured in this expanding department. Superannuation scheme. Apply to Sales Manager, Small Industrial Machines Dept., The British Thomson-Houston Co. Ltd., Blackheath, Birmingham. 5756

CONNOLLYS (BLACKLEY) Limited require a technical representative, based in London, to further sales and provide technical services to their customers in the Southern Counties. Previous experience a distinct advantage. Applications by letter to Sales Manager, Kirkby Industrial Estate, Liverpool. 5809

CONTRACTS engineer and manager for medium-sized firm of contractors and manufacturers. Only those with first-hand experience, technical ability and initiative need apply. Must be car owner. £1,000 and expenses. Application in writing.—Morley's, 117, Hornsey Road, London, N.7 (NOR. 5008). 5810

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Experience of lift equipment would be an advantage. Permanent and progressive position. Good salary. Canteen. Pension scheme. Write stating age, experience and qualifications, if any, to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Rd., Hounslow, Middx. 5721

DRAUGHTSMEN required by manufacturers of medium-voltage metalclad switchgear for their contracts drawing office. Bonus and non-contributory superannuation schemes in operation. The company is within six miles of the South Devon coast. Write, stating previous experience, age and salary required, to Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 5722

ELECTRICAL eng. company have vacancy for young draughtsman in their engineering dept. Experience in the design and development of lighting fittings preferred. Apply in writing to the Chief Engineer, Lamps and Lighting Division, Siemens Edison Swan Ltd., 38/39, Upper Thames Street, London, E.C.4. 5811

ELECTRICAL engineer, H.N.C., with automatic control, circuit and instrument experience, to work in connection with automatic weighing and bulk material handling equipment. Salary £850-£1,000 according to experience. Apply to Richardson Scale Company Ltd., Albert Street, Bulwell, Nottingham. 5835

ELECTRICAL engineer required of A.M.I.E.E. standard for chemical plant manufacturers. Experience in electrics associated with large rotating machinery H.T. and L.T. switchgear, transformers and cabling, etc. Able to prepare manufacturing specifications and be capable of engineering complete electrical projects. Knowledge of electrical protection and instrumentation desirable. Reply giving full details of experience to Chief Electrical Engineer, Air Products (Great Britain) Ltd., St. Giles House, 49/50, Poland St., London, W.1. 5836

ELECTRICAL manufacturing company in London requires a specialist sales engineer to deal with special light sources such as high-pressure discharge lamps, U.V. lamps, etc. A sales engineer with considerable technical experience in this field is preferred, but applicants with general experience in the lamp industry would be considered and suitable training given to the successful applicant in the company's research laboratory. This is a progressive appointment carrying a commensurate salary. Full particulars to—Box 5820.

ELECTRICAL manufacturing company in London requires an electrical engineer familiar with discharge lamps, associated control gear and capable of working in liaison with research laboratories and factories on design and development of associated control gear and equipment. Must be capable of carrying out lighting experimental field trials and be able to act in a technical advisory capacity. Apply in writing to the Chief Engineer, Lamps and Lighting Division, Siemens Edison Swan Ltd., 38/39, Upper Thames St., London, E.C.4. 5812

ELECTRICAL wholesaler requires experienced male staff for despatch department and stores. Apply—Newey & Eyre Ltd., 243, Horn Lane, London, W.3. 9578

ENGINEER-Surveyors required for inspection of cranes and other lifting plant. Must have drawing office experience of design of cranes, also National Certificate in Mechanical Engineering. South London or Monmouth and S. Wales. Salary £735 to £1,060 (E.S.A. scale). Non-contributory pension. Apply Eng. Dept., General Accident Corp. Ltd., 99, Aldwych, London, W.C.2. 5837

EXPERIENCED electrical engineer required by chartered quantity surveyors to prepare detailed estimates for electrical installations from schematic drawings and to measure electrical work on large site in N. England. Please reply stating age, experience and salary required to—Box 5838.

H.T. 11-kV cable jointers required for United Kingdom and the Middle East. Must be thoroughly experienced in all types of cable jointing. Please reply giving personal details, experience, past employers, etc., to—Box 5753.

INSURANCE company invites applications from electrical engineers for an appointment as engineer surveyor in the Birmingham area. Applicants should have served an apprenticeship with an electrical manufacturer and hold a Higher National Certificate, with a sound knowledge of all classes of electrical equipment and repairs. Age 25/35. Progressive salary scale, commencing £735 rising to £1,060 per annum, plus other expenses and allowances. Non-contributory pension scheme. Apply in own handwriting to—Box 5793.

INTERESTING position open with an important cinema organisation for a young enthusiastic engineer with practical electronic experience in a new and expanding field in the cinema industry. Must be prepared to travel within the British Isles. State age, education, training, experience and salary required to—Box 5794.

MANAGER for electrical repair shop. Must be accustomed to all types and sizes of rewinds and repairs. Commercial experience an advantage. Apply in writing to—Simpson Brothers (of Hapton) Ltd., Hapton, Nr. Burnley. 5843

MANAGER or manageress required for London (West End) electrical contractors' showroom. Applicants should give age and details of qualifications, experience and salary required.—Box 9579.

MIDLANDS electrical contractor urgently requires experienced man for estimating and costing. Reply giving experience and salary required.—Box 5821.

PERSONAL assistant to manager required. Applicant to have sound practical and technical knowledge as applied to construction and winding of heavy industrial electrical machines. Reply in confidence, giving age, qualifications and general experience. — Dynamo & Motor Repairs Ltd., Belgrave Terrace, Handsworth, Birmingham, 21. 5734

PRIME cost clerk, fully experienced, required by leading London electrical contractors. Write stating age, experience and salary required.—Box 5822.

REPRESENTATIVE required for London area by control gear manufacturers. Experience with contactors, relays and motor control gear desirable, but a period of training at works will be given. The post offers considerable scope for young man with initiative and electrical knowledge. Pension scheme and car provided. Write giving details of age, training, experience and salary required to Managing Director, E. N. Bray Ltd., Waltham Cross, Herts. 5813

SALES department electric motor manufacturers have vacancy for young man with initiative, enthusiasm and sound technical background. Exceptional opportunity for promotion. Full particulars to Higgs Motors Ltd., Witton, Birmingham, 6. 239

SALES representative required to handle a large manufacturer's output of domestic electrical products: immersion heaters, oil-filled radiators, greenhouse heaters, soldering irons, etc. Territory available: N.W. England. Applicants of proved sales ability should preferably have established connections with electrical wholesalers, large stores, hardware traders and supply authorities. Remuneration by salary and commission. Car or car allowance provided. Write full particulars to—Box ER.588, L.P.E., Romano House, 399/401, Strand, London, W.C.2. 5823

SUPERVISING electrical engineer required for S.W. London electrical contractors. Duties to include supervision of contracts, estimating, preparation of schemes (including underfloor heating) for council, private and industrial works. Replies, which will be treated in the strictest confidence, giving fullest particulars of age, experience and salary required, to Box 5715. All applications will be acknowledged.

SUPERVISING engineer required by electrical contracting co. for service in East Africa. Experience in preparing specifications, estimating and control of labour essential. Please write giving details of age, education and experience to—Marryat's, East Africa, 40, Hatton Garden, London, E.C.1. 5708

TRUNK telephone cable plumber-jointers required.—Box 5668.

YOUNG heating engineer required for preparing floor warming schemes. Apply in writing to Personnel Manager, Simplex Electric Company Ltd., Grindley Lane, Blythe Bridge, Stoke-on-Trent, N. Staffs, giving full details of experience. 5669

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

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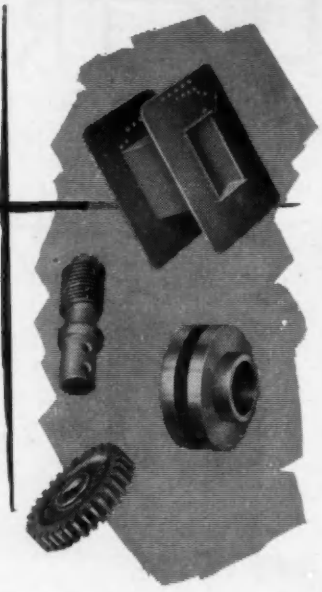

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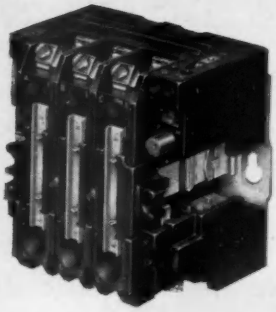

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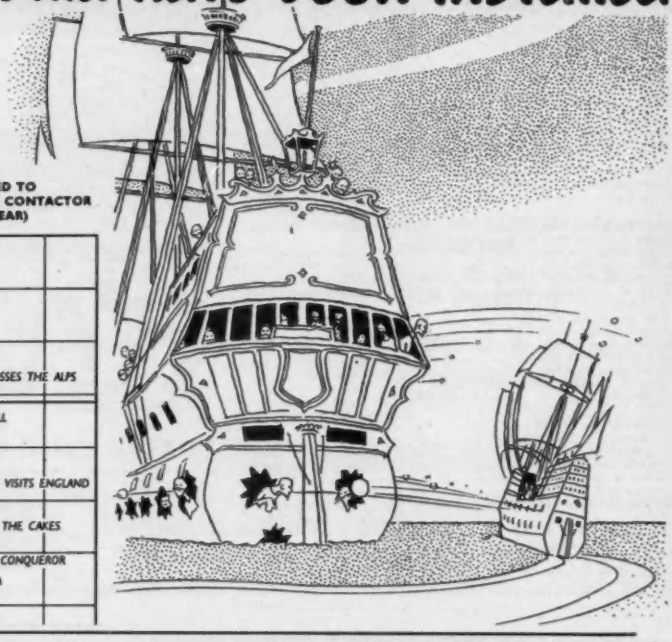

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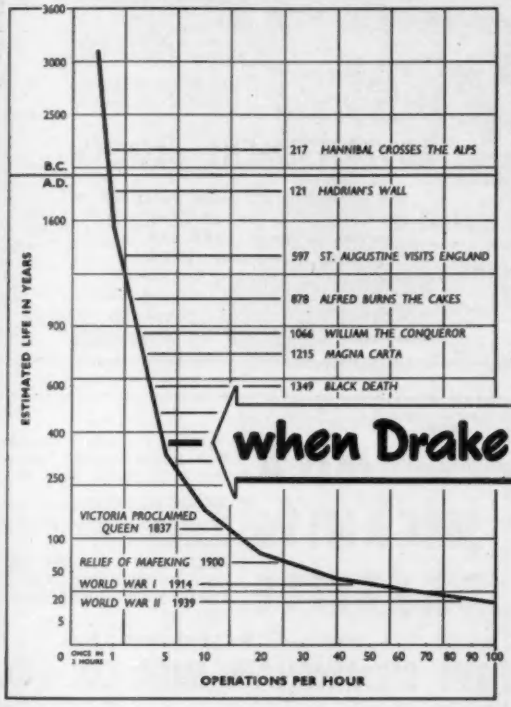

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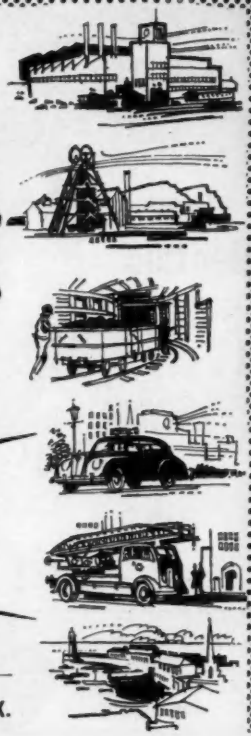

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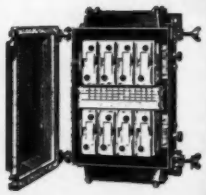

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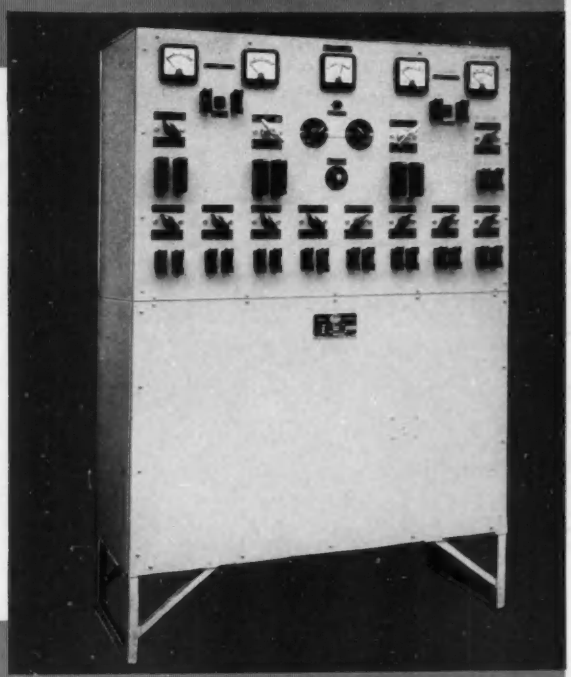

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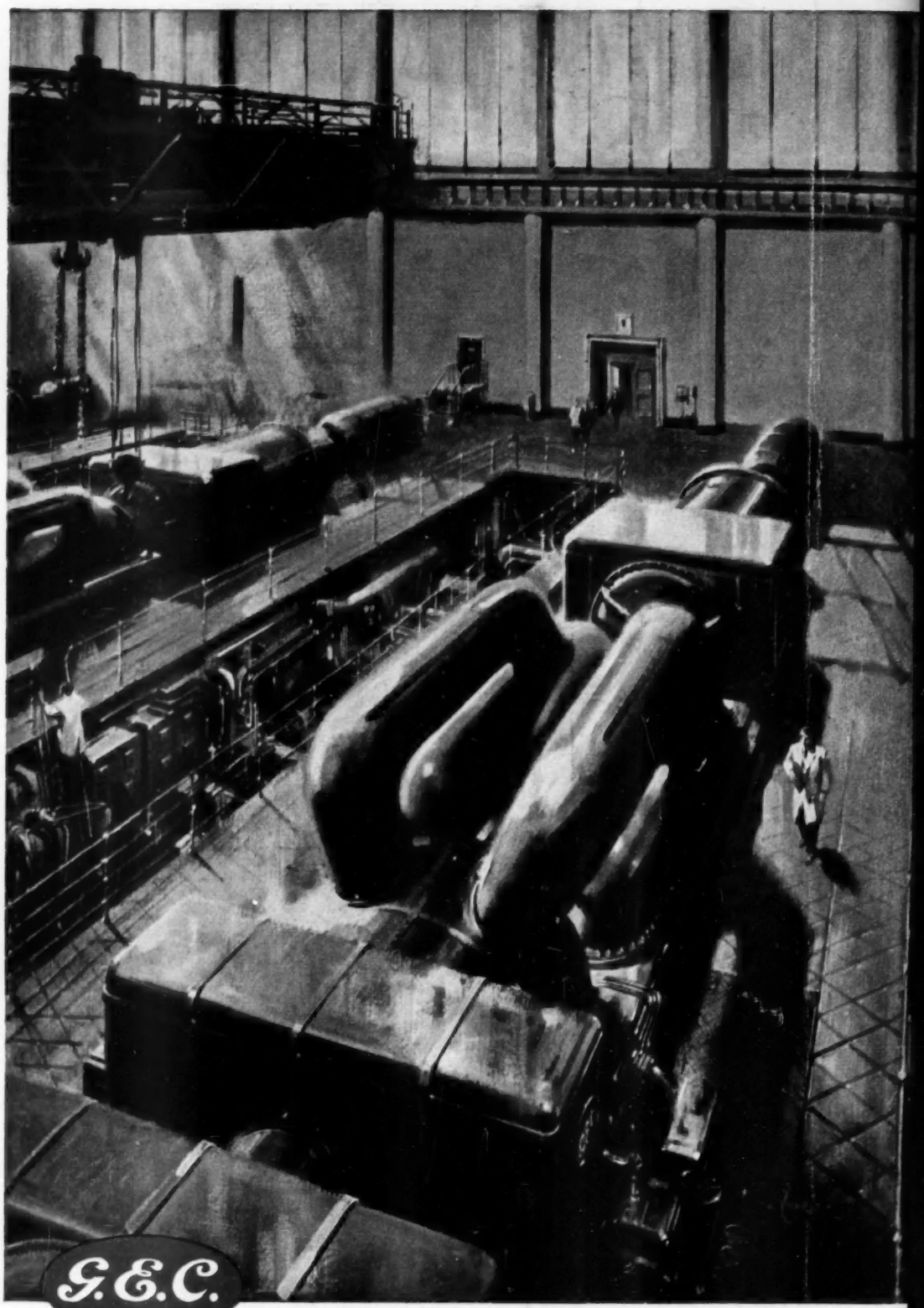
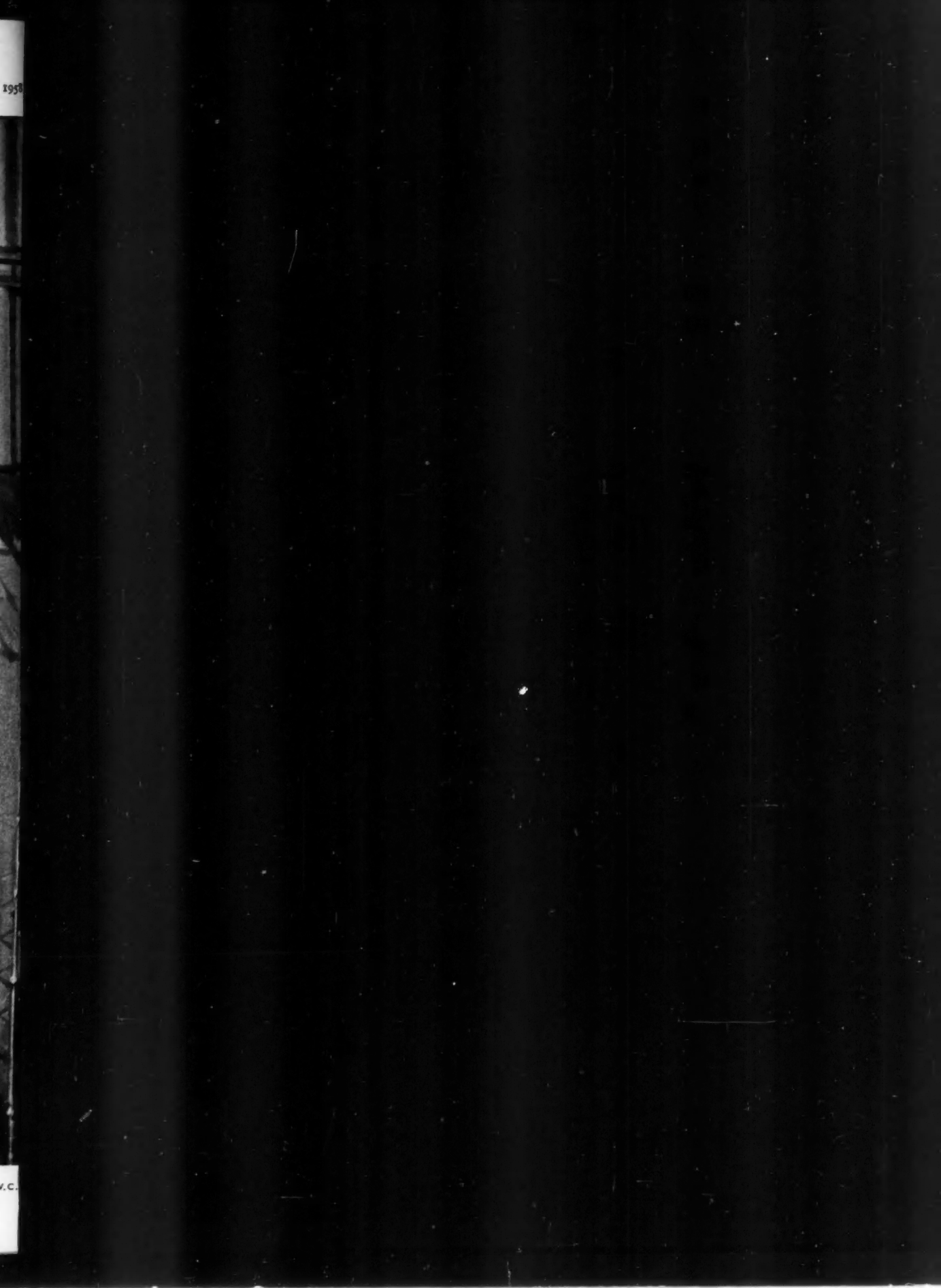
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